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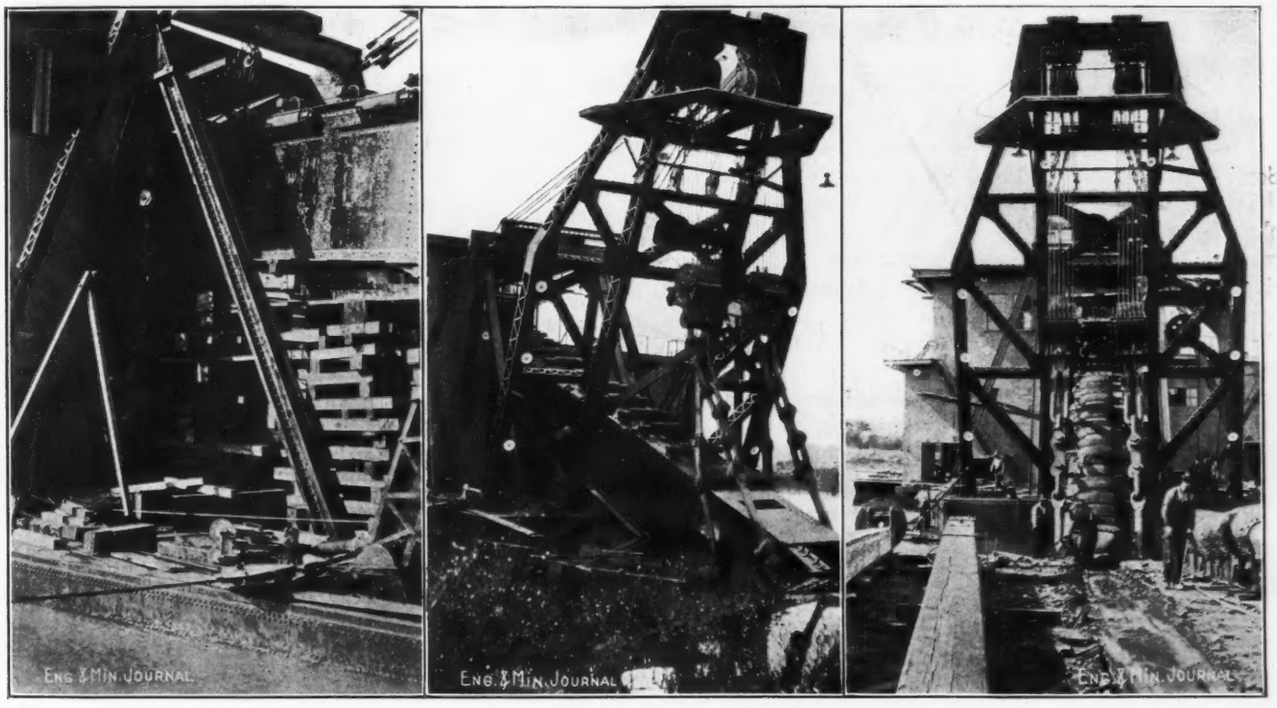
Natoma No. 10, an All Steel Dredge

By Lewis H. Eddy

There are four all-steel placer-gold bucket-elevator dredges in operation in North America and one in South America. Two are 15-cu.ft. bucket dredges operated by the Natomas Consolidated of California in the Natoma field of the American River district; two are 9-cu.ft. dredges operated by the Guggenheim interests in Yukon Territory; one is a 9-cu.ft. dredge operated by the Oroville Dredging, Ltd., in Colombia, S. A. Two others of the same type are in course of construction, one, a 9-cu.ft. dredge in the Natoma field, the other a 15-cu.ft. dredge in the Yuba Basin field of the Yuba River district, Calif. These dredges are all built by the Yuba Construction Co., of Marysville, Calif., and are equipped chiefly with Bucyrus machinery.



Natoma No. 10 Dredge under Construction

(Method of cribbing for support of digging ladder during erection.) (Bow gantry in position and the digging ladder hooked up.) (First string of buckets going up the ladder. Second string ready to go on.)

First All-Steel Dredges in California

Natoma No. 10 is the first all-steel dredge for digging placer gold built and operated in California. It is entirely new, and went into commission on Sept. 28, 1912. Natoma No. 8, of the same type, though differing slightly in some of the mechanical features, was built to replace the old No. 8 which was destroyed by fire in October, 1911.[1] The reconstructed dredge carries some of the old machinery recovered from the burned boat. It went into commission on Oct. 15, 1912. These two dredges were designed by S. L. G. Knox, then general manager of the Yuba Construction Co., now general manager of the Natomas Consolidated. Natoma No. 7 is to replace the old No. 7, which had worked out its territory. It should be completed in May. Some of the machinery from the old dredge is being installed in the new dredge. Both No. 7 and No. 8 were formerly wooden-hull boats. Yuba No. 14 is to be an entirely new dredge. The pit is ready and the steel hull parts and superstructure material are to be assembled in May ready for field construction. No. 7 and No. 14 were designed by P. R. Parker, chief engineer and works manager of the Yuba Construction Company.

Natoma No. 10 Completed in 1912

The pit excavation in which Natoma No. 10 dredge was constructed was completed in November, 1911, and the foundation or underpinning for the laying of the

[1] "Eng. and Min. Journ.," July 13, 1912, p. 67, and Sept. 28, 1912, p. 598.

steel bottom plates of the hull was begun in January, 1912. Actual construction work was begun with the laying of the bottom plates on Apr. 7. In the same month the construction of the superstructure and the main gantry was begun. On May 3 the hull was ready for the installation of the pumps and parts of the machinery installation followed. The hull plate work was completed on May 15 and the riveting of the hull was completed on June 3. In the same month the stacking ladder construction, the superstructure and the main gantry were completed, and the gold-saving tables and housing begun. On June 22 water was turned into the pit, and at 2:30 p.m. on June 24, the boat was floated.

The bow gantry was installed on Aug. 10. In the first half of August the spuds and the digging ladder were completed and ready for installation; the bucket line was assembled ashore and ready to go on the ladder; all the driving machinery had been installed and was ready for connecting to the spuds, stacking ladder, digging ladder and bucket line. Then followed the installation of the operating parts in September in the order named. (1) The digging ladder was put aboard; (2) the spuds were set in place; (3) the tailing stacker landed; (4) the bucket line installed. The installation of the bucket line was completed on Sept. 23; the gold-saving tables were finished and all connections of the driving machinery to the operating parts made ready on Sept. 27. On Sept. 28, 1912, the dredge began digging.

In the construction of this dredge the workmen employed were chiefly of the skilled classes, including electricians, machinists, structural iron and steel workers, riveters, and a few wood-working mechanics. The main part of the woodwork is in the deck. The doors and the window sash and the riffles in the gold-saving tables are of wood. The unskilled labor was generally of the better class of construction men. From the initial work in the pit excavation in June, 1911, the number of workmen varied from a minimum of 27 to a maximum of 82, and closed on the day the dredge was ready for commission with 40 men on the pay roll.

Description and Dimensions of No. 10 Dredge

The steel hull of Natoma No. 10 dredge is 150 ft. long, and 64 ft. wide, including the total overhang of 8 ft. The depth is 10 ft. 6 in.; freeboard, 24 in. The sides and stern are built of ⅜-in. steel plate riveted with ¾-in. rivets; the well hole is of ½-in. steel plates riveted with 1-in. rivets; it is 8 ft. 3 in. wide between the chafing strips. The deck is built of 6x4-in. planking, calked with two strands of oakum. The housing is constructed of panels composed of two sheets of galvanized iron inclosing "amiwud" ⅜ in. thick, painted on the outside with two coats of gray dredge paint and on the inside with one coat of the same paint. The roofing is of 1¼-in. tongued-and-grooved lumber covered with canvas duck. The pilot-house floor is concrete. The platforms are of steel and the stairways of iron. The doors and windows are of ordinary wood and glass construction. The small amount of wood used in the construction renders the dredge absolutely safe from fire that would destroy the whole or cause any large damage.

The three gantries are of steel, and with the exception of the bow gantry are of the same type and of like dimensions as installed on other large boats built by the Yuba Construction Co. The bow gantry has four legs set up in cast-steel footings, each leg resting in a separate footing. The foot of the leg is rounded so that the gantry has a forward and backward movement. This eliminates or reduces the strain on the hull which results from the common practice of setting the gantry legs into the hull as in the wooden-hull boats. The footings for the bow gantry in this dredge are supported by steel structure extending from the base of the footings to the floor of the hull, forming a foundation that eliminates the racking or twisting of the bow in particular and the entire hull in general, which obtains in the wooden-hull boats when the legs of the gantry extend through the deck and to the floor of the hull.

Objectors to this departure from common practice admit that the forward and backward motion permitted by the hinge arrangement has the advantage of eliminating the strain on the hull resulting from the lifting duty of the gantry when the bucket line is digging in particularly hard ground; but it is claimed that the strain caused by the listing of the boat to starboard and port from the swinging of the digging ladder would be better met by the support provided by building the legs of the gantry into the hull. This, no doubt, would hold true with two-legged gantries; but the performance of Natoma No. 10 dredge for the last six months has satisfactorily demonstrated that the four-legged gantry of this type is equal to all strains; and the demonstration has been made in the heaviest ground ever dug by a dredge in California.

Digging Spud Placed on Center Line

Common practice provides for the placing of the digging spud on the starboard and the stepping spud on the port of the stern end of the dredge, equally distant from the center line. In the construction of this dredge the digging spud is placed on the center line and the stepping spud is placed at starboard 14 ft. 6 in. from the center line. This departure from common practice is based on the theory that the placing of the digging spud on the center line stiffens the boat and divides the strain due to the swinging of the digging ladder to port and starboard across the gravel bank, and being directly in line with the upper tumbler the digging thrust is more uniformly distributed throughout the hull. The situation of the stepping spud is not important but convenience and the relative position of the driving machinery usually govern. The performance of the dredge has demonstrated the engineering advantage and the economy of departure from common practice in placing the digging spud.

The digging ladder is of the plate-girder type, riveted with 1-in. rivets. It is 119 ft. long between centers, and weighs 214,200 lb. without the bucket line. The bucket line is composed of 83 close-connected, 3-piece Bucyrus-type California buckets, with manganese lip, nickel-chrome steel base and pressed-steel hood; the buckets are 4 ft. wide, 2 ft. 8 in. high, 3 ft. deep and weigh 4200 lb. each; the bucket pins are of nickel-chrome steel, 2 ft. 8 in. long, 7½ in. diameter and weigh 500 lb. each. The tumblers are six-sided, each cast in two pieces and are of the ordinary Yuba Construction Co. type. The upper tumbler weighs 19 tons, the lower tumbler 11 tons. The stacking ladder is 139 ft. long between centers, and is situated at the port side of the stern end 5 ft. 6 in. from the center line of the boat, necessitated

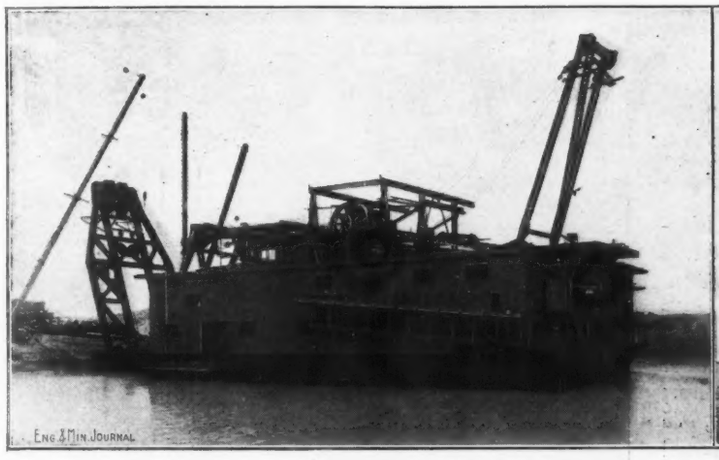
by the situation of the digging spud on the center line. The ladder rests on timber footings on a plate-steel deck, with cast-steel trunnion bearings. The conveyor belt is 42 in. wide, traveling over two drums.

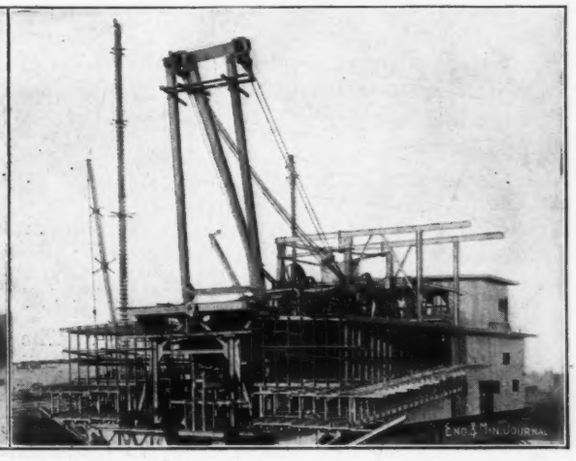
Total Weight 1400 Tons

The total weight of the dredge completed and ready for digging is approximately 1400 tons. The hull and superstructure are equal in combined weight to about one-half the total. The total weight of the digging ladder, including the bucket line, is 193 tons; the spuds weigh 86,000 lb. each, including the points which weigh 19,000 lb. each, or a total weight of the two spuds of 86 tons. The total weight of the revolving screen is 35 tons; this includes 2500 lb. of rivets. The distribution of weights and arrangement of driving machinery and operating parts are such as to float the dredge on an even keel, and to insure smooth and regular operation of machinery and economic digging.

The revolving screen is 52 ft. 6 in. long, 9 ft. in diameter. Water is furnished through three pipes. There is one 14-in. extra-heavy pipe running fore and aft through the upper part of the screen, to which are attached two rows of ball-jointed 3-in. nozzles reduced to 1½ in. The two other pipes are placed at the lower end of the screen, point from aft forward to the main header, and throw 2-in. streams. The revolving screen is situated on the center line of the boat, as is the common practice; but the screen hopper is curved to port in order to discharge the tailing gravel to the conveyor belt. The main hopper, through which the gravel is delivered from the buckets to the revolving screen, is of the ordinary type and dimensions installed on other large boats.

An efficient save-all with grizzly is situated beneath the main hopper and catches and washes the material that drops from the bucket line before the buckets reach the dump box in the hopper. Rocks larger than eight inches are separated from the finer material by bars 8x1½ in. placed about eight inches apart. These bars are directly beneath the bucket line and extend from the top of the dump box in the hopper down toward and close to the bucket idler. At the lower end of these bars and running aft are the standard 3-in. grizzly bars placed one inch apart. Here the material is again separated, all gravel over one inch in size going into the well hole and all under one inch going through zigzag sluices over the riffles. This method has proved satisfactory on this and other dredges in the field, as it saves a large amount of gold economically. The gold-saving tables are double bank longitudinal and cross system, Yuba Construction Co. type, and have a surface area of 7217 sq.ft. They are built of wood on steel frames. The riffles are 13½x29½ in., and built of wood.





Construction of Natoma No. 10

(Port side, placing of bow gantry completed. Both gantries in place.)

(The stern gantry being placed and the gold tables under construction.)

Natoma No. 10 Completed and in Operation on American River, California

Drilling and Dynamiting Ground Ahead of Dredge

The same cleanup methods are employed in the operation of No. 10 dredge as obtain on the other boats in the Natomas fleet. This dredge merely adds one more to the force in the cleanup department, which, being the most important branch of the industry, is in the hands of trained men who are under heavy bonds and who are qualified by years of experience. The large number of boats operated has necessitated the systematizing of this department to the extent that the work is practically automatic, resulting in large efficiency. The gold-saving apparatus is always in repair and proper working condition. Repairs on tables, renewal of worn riffles and other necessary work of a like character are under the direction of the superintendent of this department. The cleanup on each boat usually is made once a week. The accumulation of amalgam, mercury and gravel is carefully washed down each sluice and concentrated to about one 10-qt. bucketful of material. This is transferred to the stream box for final cleaning and separation. The cleaned amalgam is placed in an iron box or pot which is locked and taken to the retort house where it is melted into bars for shipment to the Selby Smelting & Lead Company.

Distribution of Electric Power

The dredge is electrically driven with General Electric machinery. The current is furnished by the Great Western Power Co. over a pole line from the Folsom branch of its transmission system. The wiring is 3-conductor cable system in a steel conduit. The total power used is 1090 hp., distributed as follows: Ladder hoist and main drive, 400 hp.; belt conveyor, 35 hp.; high-pressure pump, 150 hp.; low-pressure pump, 75 hp.; monitors, 250 hp.; screen drive, 75 hp.; starboard winch, 35 hp.; compressor, 50 hp.; main-drive hoisting crane, 15 hp.; shop tools, 5 horsepower.

The dredge is equipped with an Ingersoll-Rand 8x10-in. class NE-1 air compressor for operating air hammer, drills, hoists, etc. This improvement was introduced in the Natoma field with the building of No. 8 and No. 9 dredges, and will also be installed on No. 7. Each dredge has its own compressed-air plant, so that when there is a breakdown repair work can begin immediately and in the most effective manner.

Extremely Hard Digging

In the initial operation Natoma No. 10 dredge started digging as smoothly as an old boat. The machinery operated perfectly; there were no loose, heated, or even warm bearings. The area dug in the first three months contained the heaviest gravel that has been encountered in any field in California. The records of Natoma and other fields will show occasional heavy rocks, but in no other field have the rocks been so uniformly large and numerous as in No. 10 territory. In the first month nine buckets, two bucket pins and one ladder-roller shaft were broken, due solely to the excessively hard digging. In spite of the large number of buckets broken the Natomas Consolidated considered that the material used in bucket construction stood up exceptionally well, and made no claims for replacement. No. 7 had undertaken to operate in this ground, but was found to be unequal in strength to turn over such heavy and tight gravel.

The tailing pile showed that about 40% of the gravel was larger than 10 in. A large amount of the gravel going over the conveyor belt weighed approximately 200 to 1000 lb. Two hundred pieces weighing one ton or more each were brought up by the bucket line, lifted from the buckets to the deck with a hoisting crane, and thence removed to the shore. An average of 10 large rocks per day was taken off in the first three weeks. Other rocks, weighing more than two tons, were brought up by the buckets. None of these rocks was dug up and rolled to shore by the bucket line, but brought clear and landed on deck.

An accompanying illustration presents a typical view of an average pile of tailing that passed over the conveyor belt. The man's hat, lying on a boulder weighing about one-half ton, shows the comparative size of the rocks. The great size and weight of these rocks did not constitute the whole difficulty in the handling; the fact that they were tightly cemented added to the strain on the driving and operating machinery.

Slate Bedrock

In the last days of the initial period the buckets cut into a slate formation that was supposed to be bedrock. That was at a depth of 35 ft. A little more depth was gained and the buckets were cutting through the slate and encountering granitic rock. But the general bed of the gravel deposit is slate, which is found at depths ranging from 20 to 35 ft. Much of the gravel was cemented and difficult to dig even with so powerful a machine as this first all-steel dredge has proved. A portion of this area was drilled with a Keystone and shot with dynamite to loosen the gravel. This practice lessened the strain on the operating machinery and enabled the dredge to increase the yardage in the area of heavy gravel. There is an overburden of red soil covering the gravel deposits, and in some areas of this territory the bucket line has cut through similar soil containing a comparatively small amount of gravel to a depth of 30 ft. and found the slate bedrock.

The record of No. 10 dredge corresponds with the history of the Natoma field in that more gold per cubic yard is found in the areas containing large quantities of heavy and cemented gravel.

Broken Buckets on Natoma No. 10, Resulting from Digging Tight Ground Containing Numerous Large Boulders. Some of These Boulders Are Shown at Right

The gold recovered in the Natoma field varies from 4½ to 20c. per cu.yd. of gravel turned over. There are occasional areas that will produce above 20c. and others that will go below 4c. The yardage of the Natomas fleet of 10 boats runs from 130,000 to 270,000 cu.yd. per month. The depth of digging varies from 20 to 55 ft., or an average of 35 ft. below the water line, which is the measure of the depth to bedrock, and not a measure of the capacity of the dredge. The largest boats are capable of digging 69 ft. below the water line.

No. 10 dredge with 15-cu.ft. buckets is digging 30 ft. below the water line and making 220,000 cu.yd. per month. No. 8, the second all-steel 15-cu.ft. dredge is digging 55 ft. and making the same yardage. No. 1, a 13½-cu.ft. wooden boat is digging 20 ft. and making 270,000 cu.yd. No. 9, a 15-cu.ft. wooden boat is digging 55 ft. and making 225,000 cu.yd. Nos. 8, 9 and 10 are digging in hard ground; No. 1 is in exceptionally easy ground.

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The City of Potosi, Bolivia

BY A MINE FOREMAN

The wonderful mountain, on the north side of which Potosí is built, that produced so many millions in the days gone by, still continues to produce, but on a small scale. It is practically owned and monopolized by two French firms, and mining is done in a feeble, fitful way. The mining laws also that govern property rights in the mountain and vicinity, are different from those in vogue in other parts of the country and lead to innumerable conflicts, trouble and confusion of all kinds. If one good, strong company came in and bought all the conflicting interests, I believe that there is yet money to be made here, although all my information thus far has been gleaned second-hand and is to be treated as such.

Looking south from the town, the hill or mountain has the appearance of a huge triangle whose base is approximately twice its height. It is a wonderful sight. The rays from the sun shining on the thousands of old dumps give it almost the variegated colors of the rainbow, due to the large amount of iron in the rocks of which it is composed.

This city has a present population of about 35,000 people. In the colonial days, and at the height of its prosperity, it counted about 160,000 inhabitants. It is the capital of the department of the same name and is situated 180 km. from Rio Mulato, the nearest railway point on the Antofagasta & Bolivia Ry., Ltd. The present branch line from Rio Mulato has been in service about six months only. The highest point reached in coming here is 15,000 ft. above sea level.

The old mint, where so many millions of ounces of silver were coined into pieces of eight and other moneys connected with the history and romance of the Spanish Main, still stands, a relic and monument to former glory and greatness, and present decay. It is about 200x500 ft. and 30 ft. high. The coining machinery was of wood, huge beams having been dragged overland by bull teams from the Argentine, hundreds of miles away. The power for actuating the machinery was the mule. I certainly feel like taking my hat off to those old Spaniards, even if they were cruel, bloodthirsty and rapacious to the last degree. No obstacle nor difficulty was too great for them to overcome and some of their engineering feats are marvels even at this day.

This is the summer or rainy season and traveling is both dangerous and difficult, as the rivers are hard to ford, being wide as well as deep, and these are real rivers, no rivulets nor streams masquerading under that name. I certainly am not much enamored of these trips.

Note—Portions of a second letter from the author of "South America through Yaqui Eyes," published in the "Journal," Mar. 22, 1913. This letter was written early in January from Potosi, Bolivia.

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Ray Consolidated Copper Co.

The report of the Ray Consolidated Copper Co. for the year ended Dec. 31, 1912, shows that the only change of consequence in the claims and lands owned, came through the acquisition of the Ray Central Mining Co.'s properties. The area of mining claims acquired was 207.138 acres and the total area of mining claims now owned is 2144.9 acres comprising three groups of claims which lie in one connected body.

At Ray Junction, the connecting point between Ray & Gila Valley R.R. and the Arizona Eastern R.R., the company owns 129.8 acres of mill sites and other land. The lands owned at Hayden form a solid body consisting of 3684.2 acres, in addition to which the company holds leases on certain school lands, bringing the total area owned and controlled at this point up to about 4000 acres.

No drilling or development work of any character was done during the year. The total tonnage mined from the beginning of operations up to the end of 1912 was 2,247,395 tons averaging 1.72% copper; the total known tonnage remaining in the developed area is 80,656,973 tons averaging 2.2% copper. The total area developed and included in price calculations is 205.2 acres.

The original property of the company was opened up for underground mining in two vertical shafts, situated nearly a mile apart, one in the easterly and one in the westerly portion of the property. After the acquisition of the Ray Central property a third shaft was sunk in the interests of economical operation, this being intended more particularly for the extraction of a relatively high-grade orebody. This shaft was not completed until near the close of the year, and no tonnage was produced through it during the year. The total amount of underground development for the year in main laterals, drifts, shafts and raises, amounted to 133,345 ft., bringing the total since the beginning of operations up to 292,243 ft., or nearly 55½ miles.

The tonnage of ore mined from development was 29.3% of the total; that from active stopes 44.7%, and from reserve 26%. It is expected that the percentage of tonnage obtained from reserve will increase rapidly, and consequently mining cost will decrease accordingly. The ideal or most economical state will not be reached until 50 to 75% of the ore, depending on the varying local conditions, is derived from such reserve sources.

The total direct cost of mining for the year, including crushing of the ore through an inch-mesh screen and delivery of it on board cars, together with a proper apportionment of all general and fixed charges, was 77.55c. per ton. This average cost was considerably higher than the costs applying to such section of the mine as has

been sufficiently opened up to permit of economical working, and is accordingly higher than it will be in the future. The mining costs for the last quarter of the year on the same basis were 71.5c. per ton. The costs stated here do not, however, include the regular charge of 12½c. per ton against operation for the retirement of mine-development suspense account.

During the year the installation of a new compressor at the No. 1 plant was completed. This machine, having a capacity of 5000 cu.ft. of free air per minute, has been in successful operation for several months. A duplicate set of crushers and rolls was being installed at the No. 2 shaft with the intention of using it as a protection against delays in case of accident or necessity of repairs.

The Hayden mill consists of eight independent sections, each having a rated capacity of 1000 tons per day. At the beginning of the year, shipments had only reached a point where it was necessary to complete and operate five sections. During the past year the tonnage was gradually increased, each month showing an advance over the previous one, until at the end of the year seven sections were complete, six of them in continuous operation and the seventh running intermittently as required. The equipment of the remaining section is over half completed; all the material is on the ground, and it can be made ready for use within 30 days.

The total ore treated during the year was 1,565,875 tons as compared to 681,519 tons for the nine months of the year 1911 during which the mill was running. The increase of this year over last year was 884,355 tons, or approximately 130%. The average tonnage per day for the year was 4278. The average copper content of the ore treated was 1.677%, and the average recovery for the year based upon the total copper contained in concentrate produced was 68.2783% corresponding to a recovery of 22.9 lb. of copper per ton of ore. The cost of milling was 46.878c. per ton as compared with 58.45c. for the previous year. This reduction in cost reflects in a measure the natural result of handling increased tonnages without suffering a directly proportional increase in the cost of supervision, general and fixed charges, and in many of the larger items of operating costs such as power and water-supply. The sections of the mill as operated during the year have shown an economical capacity of at least 1000 tons per day.

The total production during the year of copper contained in concentrate was 35,851,496 lb. The average grade of concentrate produced was 18.94% copper and the average cost per pound of copper produced, based on the net copper returns from concentrate after smelting and refining deductions were made and after applying the dividends from the Ray & Gila Valley R.R., but not other miscellaneous earnings, was 9.828c. The average total cost for the year for mining and milling exclusive of transportation charges on ore, but including for the second, third and fourth quarters of the year a charge of 12½c. per ton of ore treated for extinguishment of mine development cost, was $1.345 per ton. The per pound costs previously stated cover all charges of every nature including the extinguishment charge above referred to. This charge amounted to 0.46c. per lb. of copper for the entire year's production. The cost per pound for December arrived at as above was 9.075c. including the same per ton charge for the retirement of development expense which amounted in this month to 0.56c. per lb. The average ore treated for December was about 5000 tons per day.

Preliminary figures for February, 1913, available at the time the report was written, indicate that on an average daily rate of approximately 6300 tons for that month, the cost per pound, arrived at as above described, was under 9c. and as not only the tonnage but the grade of ore will increase uniformly until full capacity is reached during the current year, there is every assurance that the cost per pound for the year 1913 will be well within the last named figure.

No additions as to trackage were made to the Ray & Gila Valley R.R. during the year, although some moderate expenses were incurred in improvements, such as ballasting and the improvement of yards. Of equipment only a few additional cars were purchased as needed. The net operating profit for the year was $1,814,206 and the final net profit was $1,929,262.

The Arizona Bureau of Mines

The University of Arizona, at Tucson, has established a Bureau of Mines in connection with the Mining Department of the University. It asks the coöperation of the miners and mine operators of the state in a circular, which states the object of the bureau as follows:

The bureau should collect, compile and publish statistics of all kinds regarding Arizona mines, such as production, values, types of machinery, efficiency reports, methods, mill statistics, and innumerable other things of interest and importance to every mine operator of this state as well as other states. A bibliography and library of all literature pertaining to Arizona mining and geology would be made and kept uptodate. Probably no place in the state now has such information on record. The utility of satistics and bibliography is obvious.

We should deal experimentally with Arizona problems of wet, dry and electrostatic concentration, dry placer and flotation methods and we have secured the coöperation of the mining-machinery companies in equipping our laboratories for such work. During the past year they have been good enough to equip our laboratories gratis with new machinery to the value of about $8000. Furthermore, as additional machinery is needed to deal with more complex problems there will be no trouble to obtain the desired additions.

The bureau will educate the miner and prospector. If they cannot attend the University, we shall bring the University to them—by series of lectures, articles in daily and weekly mining papers, publications of items of interest—all popular style and progressive. The employer as well as the miner should profit by this educational work. The bureau will offer to the miner and prospector a place for determining samples; practical advice and instruction, and education on the economic side; an office of exchange and information. The same data will be of service to those outside the state who desire information on Arizona mining.

We invite mine operators to send us their engineering problems, their smelting and concentration problems, their economic problems. The bureau will apply itself to the solution of these problems and publish the results, and will demonstrate in the largest way possible the mineral resources of Arizona so as to attract capital and settlers to the state. Such exploitation of the wealth of Arizona would be a constant and efficient aid to the development of the state. The nonmetallic resources of the state are peculiarly unknown, yet none is more important for all industries, none more important for the upbuilding of the state. The Bureau of Mines would be to the mining public what the Agricultural Experiment Station is to the farmer, and as such would have immense possibilities for service.

It is the purpose of the bureau to maintain a permanent exhibit of the mineral resources of the state, both metallic and nonmetallic, ores and structural materials; to study and publish results of geological investigations and to assist the miner and mine operator in every way possible.

Zinc-Dust Precipitation at Cerro Prieto

By H. S. Munroe*

SYNOPSIS—A description of one of the earliest installations of zinc-dust precipitation. Due to the foreseen exhaustion of ore, expensive machinery could not be considered so crude methods using manual labor were practiced. A noteworthy feature was the removal of excess zinc from the precipitate by dissolving it in caustic soda. Operating data and costs are given in detail.

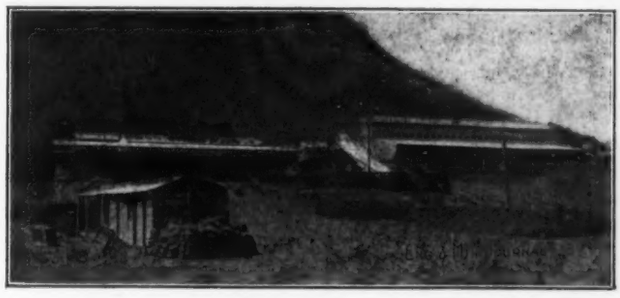
At the plant of the Black Mountain Mining Co., Cerro Prieto, Sonora, Mexico, during the time covered by these notes, the amount of solution precipitated per month varied from 34,105 to 42,979 tons, the presses being cleaned up three times each month. The pregnant solution varied in content from $0.7875 Au and 0.241 oz. Ag to $1.26 Au and 0.406 oz. Ag per ton of solution. It was the desire of the management to make as complete precipitation as possible and in good runs the barren solution was kept as low as 0.05 Au and 0.01 oz. Ag, though, owing to the practice of adding little or no zinc dust during the last 24 hr. of each campaign, the barren solution would often run up at this time, bringing the average of the 10 days' campaign to a figure double that mentioned

Crude Mechanical Methods Used

As this was one of the first plants in which zinc dust was used as a precipitant the method of adding it was crude, and as the ore reserves were being rapidly depleted at the time, it was not considered worth while to install a belt conveyor or worm system of zinc-dust feed, either of which would have insured a feed uniformity at any desired rate and would have augmented the efficiency of the precipitation. The method used was the following: The pregnant-solution tank was situated about 20 ft. higher than the presses, giving a gravity feed. The solution passed from the main tank into a mixing cone where it was agitated by air with the zinc dust, which was added by hand. After a cleanup, zinc dust was added in relatively large quantities during the first few hours to insure the rapid formation of a cake on the press leaves. After the first few hours the interval of addition was increased and the amount of zinc dust decreased, the rate of addition being kept constant from the second to the sixth day of the run when it was again decreased and about 24 hr. before the presses were broken the addition was stopped. The amount of zinc dust added varied from 0.135 to 0.212 lb. and would average about 0.155 lb. per ton of solution precipitated.

Caustic Soda for Eliminating Zinc

During the entire campaign lead acetate was added to the pregnant-solution tank at a rate varying in different runs from 0.0039 to 0.0148 lb. per ton of solution. While the solution contained some lead, it was found that this further addition materially helped the precipitation. During the first part of the time covered by these notes caustic soda was added to the pregnant-solution tank in small amounts being greatly increased during the last 24 hr. of the campaign. Later it was found that the addition of the caustic soda did not aid precipitation to any appreciable extent and its use was stopped except during the last 24 hr. of the run when it was added in comparatively strong solution.



Mill of the Black Mountain Mining Co., Cerro Prieto, Sonora

TABLE I. DATA OF PRECIPITATING CAMPAIGNS AT CERRO PRIETO, SONORA

Campaign	70	71	72	73	74	75	76	77
Tons sol. precipitated	12,597	13,509	13,500	13,960	14,526	16,743	8,744	13,556
Preg. sol. Au, $	1.242	1.072	0.923	1.126	1.025	1.081	1.013	0.838
Preg. sol. Ag, oz.	0.406	0.309	0.283	0.241	0.314	0.338	0.336	0.295
Barren sol. Au, $	0.1995	0.1615	0.1000	0.1450	0.1490	0.0490	0.1260	0.0530
Barren sol. Ag, oz.	0.0247	0.0100	0.0080	0.0040	0.0090	0.0040	0.0200	0.0102
Indicated precipitation Au, $	13,140	12,581	11,190	13,703	12,728	17,259	7,801	10,643
Indicated precipitation Ag, oz.	4803	4139	3820	3308	4430	5591	2783	3872
Zn dust per ton sol.	0.164	0.162	0.155	0.159	0.146	0.147	0.212	0.169
Lead acetate per ton sol.	0.0039	0.0052	0.0074	0.0071	0.0069	0.0066	0.0114	0.0074
Caustic soda per ton sol.	0.0161	0.0150	0.0089	0.0086	0.0082	0.0072	0.0137	0.0088
Lb. Pb in acetate	31.8	44.6	63.7	63.7	63.7	70	63.7	63.7
Precipitate								
Dry wt., lb.	866.1	958.0	757.5	693.5	697.3	982.9	975.0	846.0
Au, oz.	630.20	640.43	512.77	667.94	578.93	809.94	433.65	499.19
Ag, oz.	4921.4	4540.8	3742.7	3582.4	4308.2	5673.9	2969.5	3840.5
Per cent. Au plus Ag in ppt.	43.90	37.12	38.58	42.00	47.90	45.20	23.90	35.10
Per cent. Zn in ppt.	23.0	25.3	24.4	22.8	16.6	16.8	33.6	24.1
Per cent. Pb in ppt.	10.4	15.1	15.4	15.4	15.1	13.5	14.1	18.6
Lb. Zn in ppt.	199.5	242.0	189.0	158.0	116.0	165.0	327.0	204.0
Lb. Pb in ppt.	90.2	144.0	119.0	106.0	105.0	132.0	137.0	157.0
Lb. Zn dust added to sol.	2061	2194	2094	2228	2128	2460	1862	2194
Lb. Zn dissolved or replaced	1860	1952	1905	2070	2012	2295	1535	1990
Per cent. Zn dust dissolved or replaced	90.30	89.1	91.0	92.7	94.4	93.2	82.5	90.8
Lb. Zn dust per ton, sol.	0.148	0.144	0.141	0.141	0.138	0.137	0.175	0.147
Lb. Zn dust dissolved or replaced per oz. fine metal	0.335	0.377	0.447	0.486	0.412	0.354	0.451	0.458

This caustic was added solely to dissolve the excess of zinc as the precipitate was smelted without acid treatment. It was at first feared that the zinc going into the solutions would foul them, but this was not experienced. It can be explained, theoretically at least, by the following equations:

$$2\,NaOH + Zn = 2\,H + Na_2ZnO_2$$

and

$$Na_2ZnO_2 + Ca(OH)_2 = CaZnO_2 + 2\,NaOH.$$

*Mining engineer, Golden, Colo.

The Na_2ZnO_2 is the soluble salt which would have fouled the solution had the ZnO_2 not been precipitated by the lime added to preserve the alkalinity of solutions. It also regenerates the NaOH, as shown above, with beneficial results, which were noted at the time but not accounted for.

Caustic-Soda Method Warrants Furthur Research

Under ideal mechanical conditions it is probable that this method of eliminating excess zinc in precipitation would be far more satisfactory than acid treatment and the ideal could be closely approached by using great care to feed the dust in such a way as to insure regularity and avoid excess, thus making for a homogeneous cake formation, and to prevent the dropping of the cake at any stage, which can be accomplished by keeping it relatively thin and never letting the pressure relax. Possibly it would be better practice to finish a campaign by cutting in a barren caustic solution and cutting out the pregnant solution, letting the former run until the evolution of hydrogen had nearly ceased, a matter of perhaps six hours. In any event the method is worthy of experiment, especially after a partial success at least was achieved at the plant under discussion.

The Personal Element Variable

The accompanying table shows the results of eight precipitating campaigns, which may be taken as representative. Campaigns 71-75, inclusive, show the working toward almost ideal conditions, and the results in campaigns 74 and 75 were as good as could be expected with the installation. After No. 75, any falling off in efficiency was due to mechanical rather than chemical causes. The main difficulty was in the dropping of the cake, due to decrease in pressure or failure of the personal element in the zinc-dust feeding, the failure being usually on the excess side.

TABLE 2. COST OF PRECIPITATING AT CERRO PRIETO

	Per Ton Ore Treated					Per Oz. Fine Bullion				
1909	Zinc Dust	Lead Acetate & Caustic	Labor	Supt.	Total	Zinc Dust	Lead Acetate & Caustic	Labor	Supt.	Total
January	0.0282	0.0041	0.0018	0.0008	0.0349	0.0643	0.0094	0.0041	0.0019	0.0797
February	0.0298	0.0037	0.0019	0.0010	0.0374	0.0332	0.0048	0.0024	0.0012	0.0416
March	0.0262	0.0027	0.0018	0.0008	0.0315	0.0281	0.0028	0.0020	0.0009	0.0338
April	0.0199	0.0025	0.0018	0.0008	0.0260	0.0251	0.0032	0.0022	0.0011	0.0316
May	0.0160	0.0035	0.0017	0.0008	0.0220	0.0231	0.0036	0.0024	0.0011	0.0302
June	0.0158	0.0025	0.0017	0.0008	0.0208	0.0215	0.0035	0.0023	0.0011	0.0284

It will be noted that the amount of caustic soda used decreases, due to increasing intelligence in its use. That more lead is recovered in the precipitate than is added as acetate is accounted for by the presence of small quantities of comparatively soluble lead salts in the ore. The presence of this lead in the precipitate was beneficial rather than detrimental as it was recovered and utilized in the method of refining used. The accompanying table of costs covering six months' representative operations is of interest. The cost per ton of ore is figured on a basis of treating from 29,000 to 30,000 tons per month.

Duriron Is the Trade Name of a Noncorrosive Iron Alloy recently put on the market. The alloy, according to "Engineering News," Mar. 20, 1913, is quite resistant to ordinary rusting and only slightly attacked by alkalis and acids. Although the exact composition and manufacturing processes are not announced, it is known that about 10% of silicon enters into the material. It closely resembles cast iron, but is about 10% lighter; it is more brittle, a better conductor of heat and electricity, and also much harder. It can be worked only by grinding, preferably with carborundum. It shrinks considerably in casting, and is not recommended for ordinary foundry work. Apparatus is made to order from the alloy by the Duriron Castings Co., of New York.

Occupational Diseases in Chemical Trades

A committee on occupational diseases in the chemical trades was appointed by the New York Section of the American Chemical Society in February, 1912. The objects of the committee may be specifically stated as follows:

(1) To hold itself ready to advise the legislatures of New York and New Jersey in reference to matters pertaining to occupational diseases in the chemical trades. (2) To study various bills presented in the legislatures in an effort to avoid unwise legislation; especially that which might be inoperative or ineffective from one or many reasons resulting from lack of technical knowledge at the time of writing the laws. (3) To inaugurate and superintend such investigations as might be decided upon which look toward improvement of conditions of labor in the chemical trades.

The personnel of the committee is: Dr. Charles Baskerville, professor of chemistry and director of the laboratory, College of the City of New York, chairman; B. C. Uhlig, chief chemist, Brooklyn Union Gas Co., Brooklyn, N. Y., secretary; Dr. George P. Adamson, Baker & Adamson Chemical Co., Easton, Penn.; W. H. Bassett, technical superintendent and metallurgist, American Brass Co., Waterbury, Conn.; Dr. William F. Doerflinger, consulting chemist, New York City; Dr. H. M. Kaufman, general manager, Mutual Chemical Co. of America, New York; Dr. Charles F. McKenna, chemical engineer, New York; Dr. A. C. Langmuir, chief chemist, Marx & Rawolle, of Brooklyn, N. Y.; Dr. Charles L. Parsons, chemist, Bureau of Mines, Washington, D. C.; Dr. George A. Prochazka, general manager, Central Dye Stuff & Chemical Co., Newark, N. J.; Dr. George D. Rosengarten, Powers, Weightman & Rosengarten, Philadelphia, Penn.; A. H. Sabin, consulting chemist, National Lead Co., Brooklyn, N. Y.

To date the following work has been undertaken or completed, namely:

(1) Dr. Charles L. Parsons, mineral chemist of the Bureau of Mines, Washington, reports that the Bureau's experts engaged in studying mineral resources and utilization under instructions from Dr. J. A. Holmes, director of the Bureau, are noting health conditions and collecting information on occupational diseases in chemical trades in so far as they relate to mining and metallurgy. When funds are available, bulletins will be issued on the subject from time to time. (2) Dr. Charles F. McKenna was retained by the Factory Investigating Commission of the state of New York, as chemical adviser to Dr. Charles M. Price, medical director, who supervised the investigation of the chemical trades in New York State. Doctor McKenna's work was associated with the manufacture of commercial acids. Dr. Charles Baskerville prepared a report for the Factory Investigating Commission of the State of New York on "Wood Alcohol."

Microscopy in Economic Geology

By R. Beck

SYNOPSIS—The microscopic study of thin and polished sections has had great influence on the development of economic geologic theories. It is applicable to the study of almost all types of deposits. Its practical applications not limited to metal deposits or even to geologic field. Microscopic petrography important for mining engineer.

The great advances which have been made in the systematic and genetic knowledge of minerals and rocks since the application of the microscopic method of investigation are well known. So numerous are these results that they can hardly be comprehended. But a limit has already been reached, beyond which a fruitful development of the science through this means alone is scarcely to be expected. After a surprising number of unlooked for constituents were shown to be present in the rocks and thereby entirely new points of view had been opened up to systematics, the investigation of the structure or the manner of intergrowth of the constituent minerals of rocks was brought into the foreground, and attempts were made to draw important genetic conclusions from these results. It was found, however, that the bulk chemical composition of rocks, which had fallen into comparative neglect after the introduction of the microscope, as contrasted with the preceding period of the hand lens, was a significant genetic factor. Chemical analysis was therefore again established on a new basis, and its results successfully applied to genetic classification. But even then the goal was not attained. Experimentation, especially fusion in the electric furnace, which was formerly employed on only a few isolated problems, began to attain general importance in modern petrography. But here also the microscope is necessary; for by means of it thin sections of the natural occurrences are compared with sections obtained from artificial melts. It is evident that in this field petrography frequently comes in contact with metallurgy and especially with metallography.

Early Petrographers Neglected Opaque Minerals

Along the path of development which has just been sketched, petrography on the whole bothered itself but little with economic geology. The petrographers of the '70s and later, for example, treated with a certain disdain the disseminated ore minerals which are usually found as essential or accessory components of rocks. This is apparent in their vague designation of these as "opaque constituents." Different ores, as well as particles of carbon and graphite, were brought under this heading without further investigation. The fact was not heeded that these inclusions, in spite of their minute quantity, often plainly indicated the genesis of the rock in question. A microscopic investigation of the composition and structure of actual ore deposits was seldom attempted. Especially were the nonmetallic deposits avoided by the petrographer.

Happily, during the last decade these conditions have completely changed. Everywhere the importance of the microscopic method for the investigation of ore deposits of all kinds has been recognized, especially in the treatment of practical geological questions. Among the first and foremost in this work has been the Freiberg school of geologists, whose efforts have been rewarded with many important results.

It is not intended to relate here in chronological sequence the achievements of the microscopist in this field, but rather to give a review of the results that have been obtained, following in this the order of the systematic classification of ore deposits. The metallic deposits will first be taken up in accordance with the genetic classification in Beck's "Lehre von den Erzlagerstätten."

Influence of Microscope on Conception of Magmatic Segregations

In the very first genetic group, the magmatic segregations, we see that the microscopic appearance of a specimen often alone determines the entire conception of it. It is relatively easy to examine an ore which contains only one ore mineral in addition to the silicates and other minerals which are transparent in thin section. To distinguish several opaque minerals from one another is more difficult. For this purpose reflected light is being used with great success by means of a simple vertical illuminator, or even by direct sunlight or ordinary electric light. In more difficult cases, highly polished surfaces are prepared and electrically illuminated in the Le Chatelier metallographic apparatus. The different ores can then be still further distinguished through careful etching; and recently artificial tarnishing has also been produced and used in the diagnosis. In this way it is possible to determine the order of deposition of the different minerals, and hence gain a valuable insight into their mode of origin.

The study of the platinum of the Urals might be cited. By this means, it was shown that the grains possess a zonal structure, such as is typical for crystals formed from a molten mass, as the augites in basalts or the feldspars in many porphyries. On the other hand, it was brought out that before the separation of the platinum, the separation of the chromite was already complete. Further, it could be shown in some cases where the platinum contained considerable osmium and iridium that crystals of osmiridium or newjanskite were scattered through the platinum grains, their separation taking place therefore between that of the chromite and that of the platinum. The last member of the sequence was always a silicate, olivine. All these observations established the segregation of the rare metal from the molten magma, also in those cases where the platinum occurred together with magnetite intergrown in a pyroxene rock. In the same way the origin of gold has been determined, such as the primary gold in the silicates of certain gabbro-diorites of Madagascar. If, on the other hand, the microscope discloses that, in any igneous rock whatever, native gold is found only where secondary quartz and pyrite occur, then the subsequent introduction of auriferous solutions must be assumed; this is the case in many of the supposedly

Note—This translation of the address delivered by Professor Beck on the occasion of his inauguration as rector of the Royal School of Mines at Freiberg, Saxony, Oct. 3, 1911, was made with his permission by Joseph T. Singewald, Jr., of the geological department of Johns Hopkins University. The German title is "Ueber die Bedeutung der Mikroskopie für die Lagerstättenlehre."

primary gold-bearing diabases and epidiorites of Australia.

The theory of the magmatic origin of many oxidic chromium and iron ores was greatly fortified by means of the microscope. We know now with certainty that all workable chrome-iron ores were derived from magnesia-rich magmas. The origin of the gigantic ore deposits of Lapland was also worked out primarily through the use of the microscope, though aided by geological field investigations and boring operations conducted by the mining interests.

Application to Problem of Sudbury Ores

The problem of the sulphides in the gabbros, norites and diabases was more difficult. He who is familiar with the literature on the important deposit of Sudbury as well as that on the small occurrences at Sohland, on the Spree and Schluckenau, knows how difficult it was for geology to arrive at a generally accepted genetic conception of these ores. The microscope has shown that the old view of the magmatic nature of these ores applies to the extent that a part of the existing nickeliferous pyrrhotite and chalcopyrite actually must have segregated direct from the molten magma; and in the case of the great Canadian deposits this was by far the greater part. On the other hand, thin sections show that probably a thermal solution and redeposition of finely divided ore particles took place, giving rise to the formation of compact secondary masses of ore. A metamorphism of the rock preceded this redeposition, so that the secondary green hornblende, which is attached to the pyroxenes in delicate fringes, is in turn surrounded by pyrrhotite. The nickel content of the pyrrhotite is now also explained. The microscopy of highly polished surfaces established as true what had already been indicated as probable, through small-scale magmatic separation, namely, that there is an intimate mechanical intergrowth of common pyrrhotite and a nickel sulphide, pentlandite. The intergrowth is unfortunately so intimate that a commercial concentration is out of the question.

The modern conception of the next group, the contact metamorphic ore deposits, has been made possible largely through the microscope. Often the investigation of a single small sample of such ore suffices to make clear at once its genetic position, since structure and paragenesis are extremely characteristic here. Whoever knows how in accordance with the experience of the last decade the economic value of such contact metamorphic deposits has turned out in comparison with that of the magmatic or other types, will also know how to make commercial use of such a preliminary diagnosis when the occasion arises.

Application to Field of the Veins

Within the field of the veins, one group of phenomena in particular has been elucidated, that concerning the replacement processes, or metasomatism. Of course, in certain vein-types these processes were understood in the premicroscopic period, as for example in the tin veins. Charpentier in his day pictured the steep-dipping tin veins of Geyer, which, together with the flat veins, are splendidly exposed, and he described very clearly how in the transition zones the feldspars of the granites were altered to gray quartz, besides cassiterite, arsenopyrite and other ores. The microscope, however, pointed out such phenomena in other vein groups with unexpected frequency. Only with its aid could we, for instance, understand the nature of sericitization, which is so widespread; and only thus were we able to recognize the same transformation along the courses of active thermal springs. It was found that replacement occurs not only in the country rock in place or included in the vein mass; but also in the vein material itself. The microscope decides whether the quartz is a primary deposit or whether silicic acid has subsequently replaced carbonate gangue minerals and barite, as at Schneeberg, or siderite, as in the Sieg district.

Replacement Processes Shown as Occurring in Epigenetic Deposits

On a far larger scale the microscope has shown replacement processes to have occurred in stock-shaped and bedded, epigenetic deposits. Here, in particular, have thin sections proved, through the presence of fossils replaced by ore, whether a cavity was formed and then filled with ore, or whether the original rock was replaced molecule by molecule with the metallic compounds.

There were problems of the greatest scientific and economic interest in the field of the epigenetic bedded deposits, in the solution of which no progress could have been made without the new method. Among others, the problem of the Witwatersrand suggests itself here, calling for an abundance of nice investigations, part of which belong to the best known microscopic petrographic achievements. The microscope soon showed that the early conception of this most famous gold deposit of the world as a complex of fossil gold placers, was erroneous. In its place, it gradually unfolded a picture of chemical-geological processes far more complicated than at first suspected.

These few suggestions indicate that the purely scientific progress attained by the use of the microscope is to be highly valued. It is not difficult to demonstrate further, however, that the scientific prospector and economic geologist can turn to direct practical account his examinations of thin sections, if they are correlated with field investigations. Above all, the microscopic method tells in many cases to what genetic group the prospected ore deposit belongs. The different genetic types are not of equal economic value. The microscope determines, for instance, in many cases whether one is dealing only with a local enrichment or with the outcrop of a large deposit; in other words, whether only short-lived operations are to be expected or whether the investment of considerable capital is justified. Here, in particular, might be pointed out the cementation phenomena immediately under the gossan, typically known in the case of copper and gold deposits. They are often difficult to recognize macroscopically, but very easily recognized microscopically. Their presence determines a rich zone under the gossan, which formerly was, and even now is, often considered in new discoveries to represent the normal primary development of the orebody. Enterprises basing their returns on the metallic content of this zone may experience a severe setback or complete failure when operations have penetrated through the cementation zone. An examination by reflected light of polished surfaces of such secondarily enriched ores reveals their extremely characteristic structure and warns one against committing mistakes.

Aid to Solution of Ore-Dressing Problems

Much important information can also be obtained by the millman from thin sections. An example is the still

unsolved milling problem of the sphalerite ores of the St. Christoph mine, at Breitenbrunn, Saxony. The difficulties of that problem can be understood only after one has seen in thin section the unusually delicate lamellæ of sphalerite locked between the cleavage plates of the hornblende, which is besides intimately intergrown with magnetite. At the present time the large testing laboratories generally use only a hand lens or a binocular microscope to test middlings and concentrates. A study of thin sections would, in many cases, greatly shorten the experimental work.

Relations of Old Deposits and Attempted Salting Discovered with Microscope

In the tracing out of old ore deposits, forgotten in the course of time, our instrument can also perform good service. For example, it was successfully applied to determine what sort of ores (particularly the type of the deposit) were worked in an ancient stamp mill in regard to which no records were procurable. The fragments of lean ore particles found in the grass-covered slime-dump revealed such characteristic structures that the investigator was at once oriented as to the nature of the deposits worked; whereas the assayer could have proved only the occurrence of certain metals. In another case the identity of certain rich specimens in an old collection with the meager remnants of an old dump could be established microscopically, and thereby the authenticity of certain records.

Dishonest manipulations also can be detected through the microscope, and in that way business losses prevented. Once the characteristic forms of gold filings with which a swindler had salted a prospect betrayed his scheme. Another time, minute hammer-marks were discovered on artificially flattened, finely granulated brass with which a conscienceless owner of a claim had "improved" a placer showing, the salting of which with real gold alone would have been too expensive.

Genetic Relations of Blue Ground Microscopically Determined

Our knowledge of the nonmetallic deposits has also been advanced in many ways through use of the microscope. The theory of the origin of the South African diamonds, for example, has been strongly confirmed by thorough structure-studies of the "blue ground." The genetic relations between that remarkable country rock of the South African precious stones and other known types of eruptive rocks were disclosed only by this means. To be sure, the mere determination of the accompanying minerals often decides in a doubtful occurrence whether one is dealing with "blue ground" or not. Before one undertakes costly explorations and washing tests on a large scale, however, a microscopic examination is essential. Various rocks have been considered "blue ground," which the microscope recognized as not genuine.

Coals and Salts Susceptible to Microscopic Examination

In spite of their apparent opaqueness, the coals are also susceptible to microscopic examination. We already have means of lighting up, to a certain extent, the field of sections and slices. The theory of the origin of coal seams has taken advantage of such investigations, which, of course, presuppose a thorough botanical training on the part of the investigator. It has in this way been demonstrated that algae are the principal constituents of certain saprolitic coals.

The salt deposits still remain to be mentioned, the microscopic appearance of which has recently been used in support of all kinds of theoretical conclusions. Differences in structure permit one to determine, for example, whether certain potash salt bodies belong to an older or younger generation, and this knowledge can be turned to industrial advantage in assisting to unravel the frequently complicated tectonic relations of these deposits. The thin sections are prepared on a ground-glass plate with emery and corozo-nut oil, washed in ether, and mounted in Canada balsam.

Application to Study of Structural Materials

In an entirely different field of practical geology, the application of the microscope enables one to pass an opinion on rocks which are to be used as building stones, as decorative material or as works of art. It has been shown that especially in the investigation of resistance to weathering, the microscope performs important services, which cannot be performed by the other methods customarily used in testing building material. Especially valuable are the comparative microscopic studies of rock used in building which has resisted weathering for a long time and that which is in process of disintegration. The cause of rapid weathering can be recognized as a natural structural relation. Two granites, for instance, of almost identical mineralogical and chemical composition can behave quite differently. The one remains sound for years; the other disintegrates rapidly because delicate microscopic pressure zones run through it. Two marbles of equal beauty show entirely different powers of resistance as material for a work of art exposed to the weather, according to whether the calcite individuals in thin section interlock with sinuous outlines or merely adjoin each other as paving stones.

Recently the microscope has also been applied to the scientific investigation of mortar, stucco, dead-burnt plaster of paris, floor plaster and other important artificial products. Finally, the broad microscopic field of metallography might be mentioned into which, however, we shall not go.

Various circumstances have fortunately greatly facilitated this extensive application of the microscope. The convenient types of this instrument which were placed upon the market at relatively low prices by the German optical industry were of particular advantage in this regard. In addition there appeared a number of good textbooks for the study of microscopic petrography.

From this review the conclusion is inevitable that microscopic petrography must have a place in the curriculum of technical schools and especially of mining schools. Such mining and geological engineers as wish to train themselves for consulting work, or such as wish to participate as pioneers in the mining development of new regions, and above all, such as are striving to take an active part in the scientific part of practical geology, must unquestionably familiarize themselves with the fundamental methods of microscopy.

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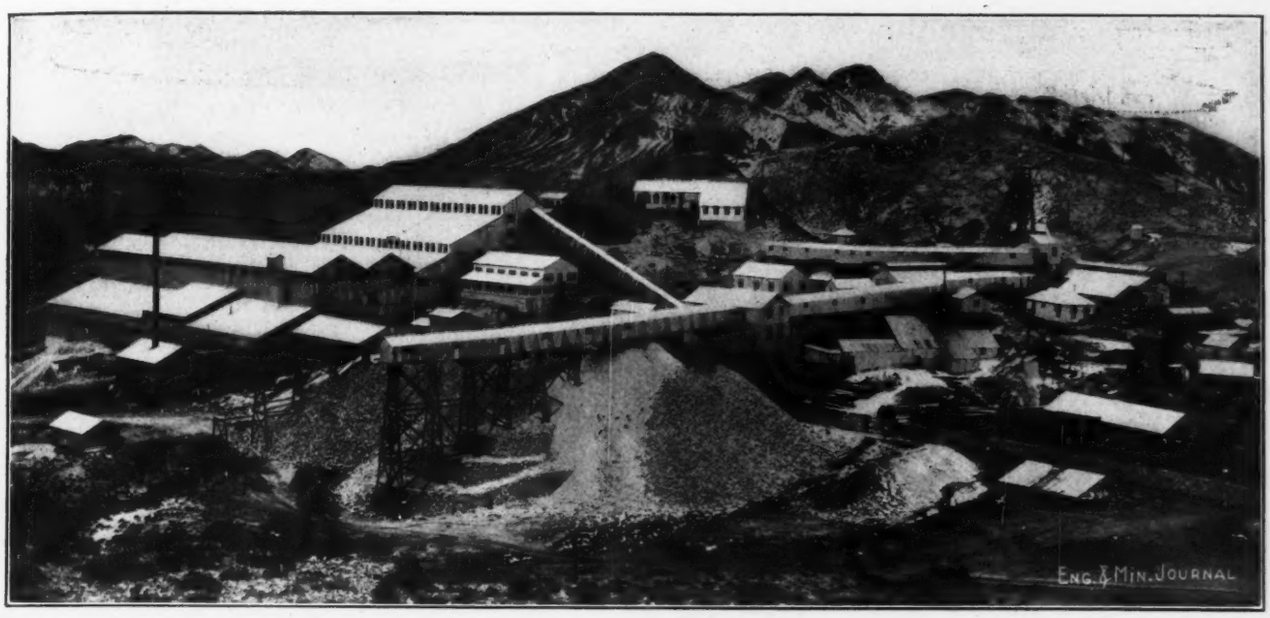
The Production of Lead and Zinc Ore in Arkansas in 1912, according to J. P. Dunlop, of the U. S. Geological Survey, was 32,755 tons, averaging 0.1% lead and 2.7% zinc. The concentrates produced included 39 tons of galena, 1419 tons of blende, and 462 tons of calamine.

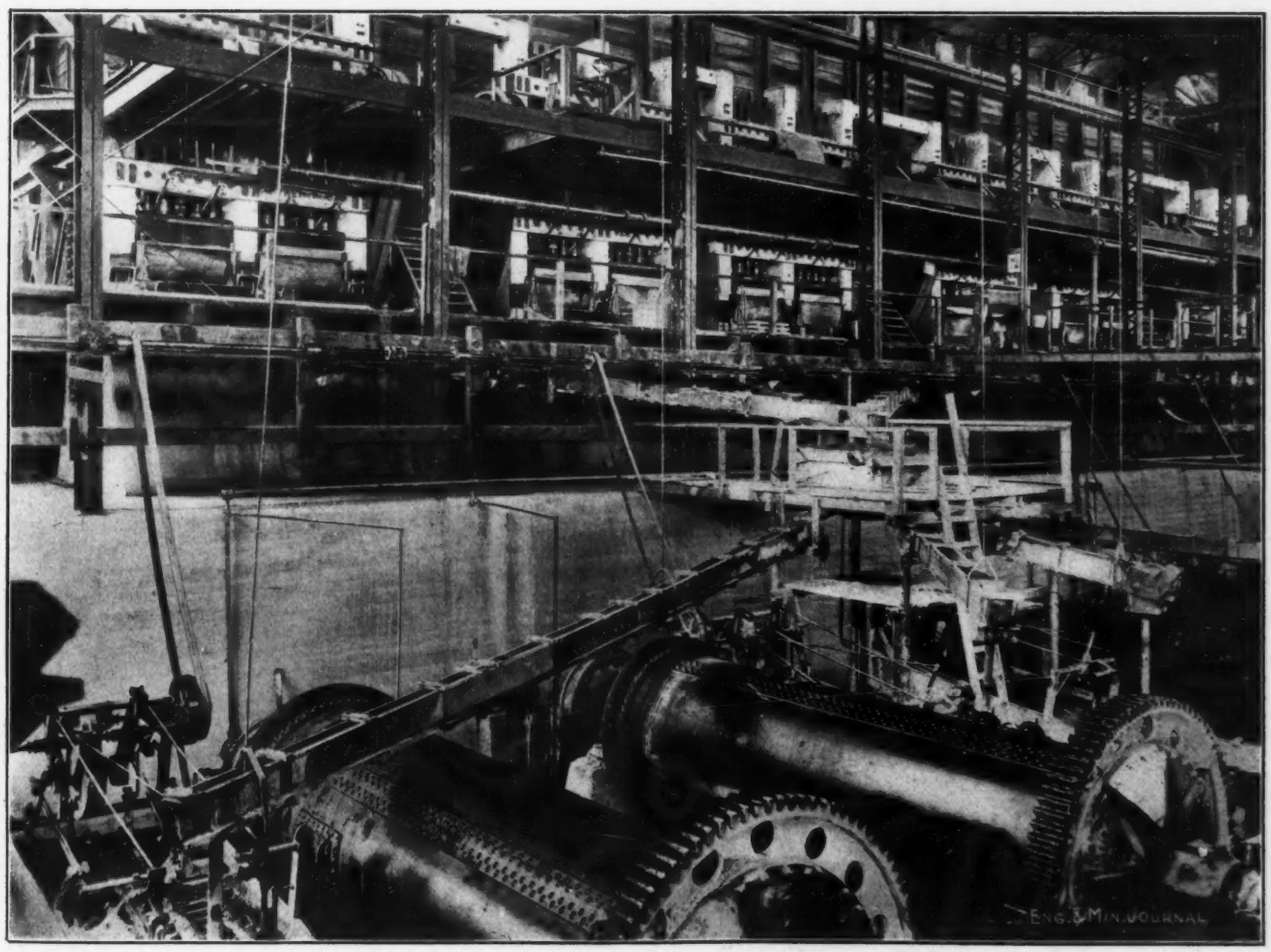
PHOTOGRAPHS FROM THE FIELD

DRILLING OPERATIONS AT TONOPAH-BELMONT MINE

TRIANGULAR TIMBER SETS USED AT TONOPAH-BELMONT MINE, TONOPAH, NEV.



SHAFT AND NEW MILL OF TONOPAH-BELMONT DEVELOPMENT CO., AT TONOPAH, NEV.



STAMP BATTERIES AND PART OF THE TUBE-MILL FLOOR AT NEW BELMONT MILL

The tube mills are shorter and of greater diameter than commonly used. One Dorr classifier receives the discharge from each tube mill and returns the sand directly for regrinding.

Slinging and Handling Material

There is a great difference between ropes and slings used for hoisting. In ropes the wear can always be seen by the strands becoming frayed, loose or cut. A chain, outside of a few bruises, will not show any signs of weakness; although actually it may be full of small cracks which cannot be seen by the naked eye, or it may be much crystallized by long use. A chain under these conditions is rapidly becoming weaker with each lift, until it finally gives way.

There are many varieties of hitches and many kinds of knots, some of which are shown in Figs. 1 to 11. Many of these, although useful for riggers, millwrights and others handling special machinery and materials, should be used only by men competent in such work.

Note—Excerpts from an article in the "General Electric Review," March, 1913, by John Riddell, mechanical superintendent, General Electric Schenectady Works.

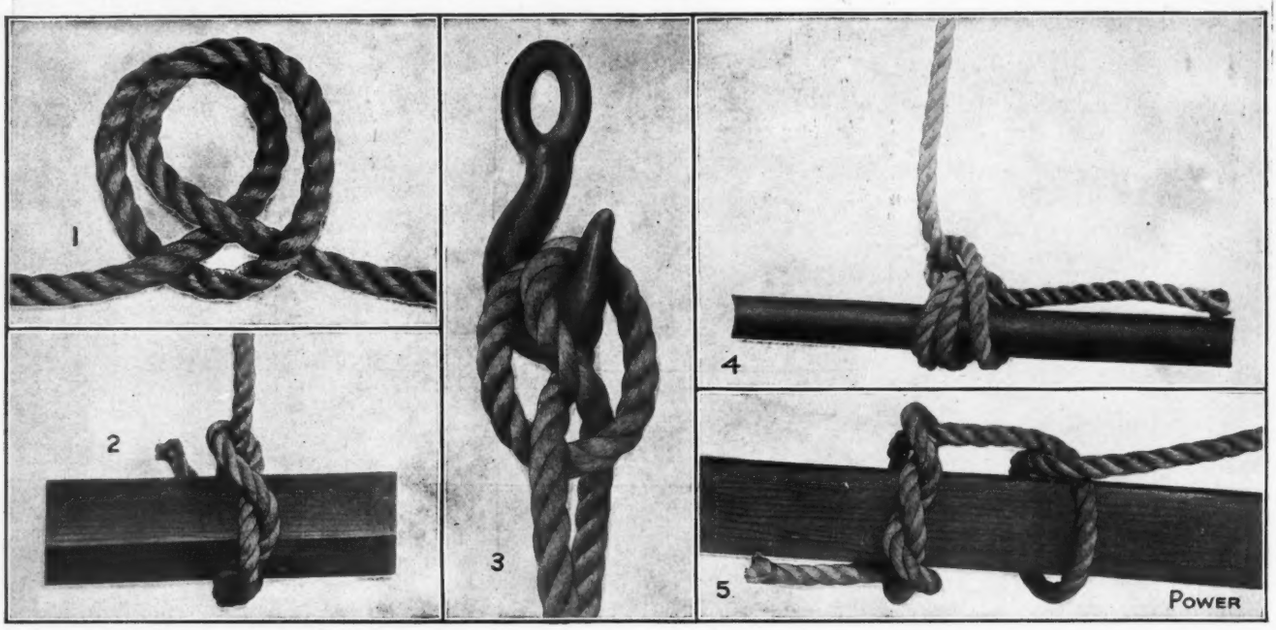


Fig. 1. Clove or double half hitch. Fig. 2. Timber hitch. Fig. 3. Clove or double half hitch adapted for hauling. Fig. 4. Studding sail hitch, useful in hoisting timber. Fig. 5. Timber and half hitch, useful in hoisting shafts or timbers in vertical position.

FIG. 14. PROPORTIONS OF EYE-BOLTS (SEE TABLE 1)

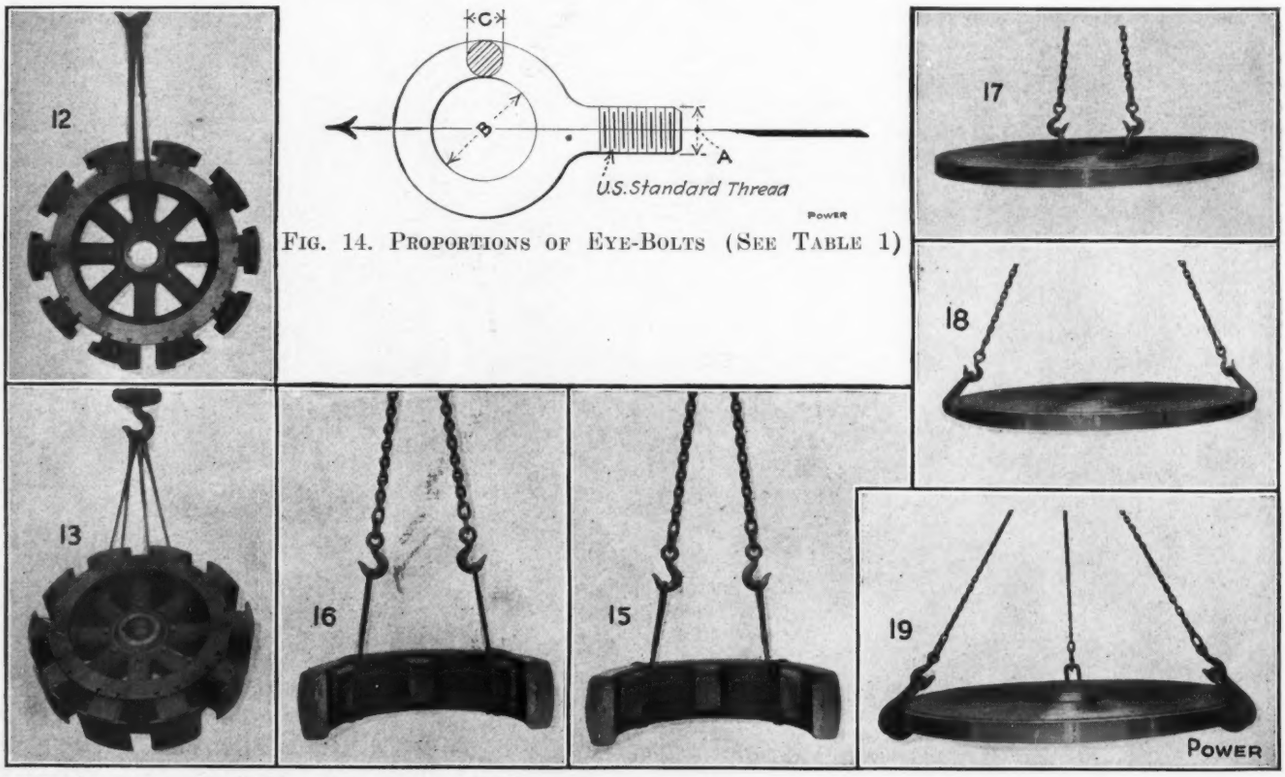


Fig. 12. Improper method of making a hitch for turning revolving fields with two slings. Fig. 13. Proper method of making hitch for turning revolving fields. Figs. 15 and 16. Wrong and right ways of making a hitch. Figs. 17 and 18. Wrong and right use of double hooks. Fig. 19. Three double hooks—preferable where possible.

Wire-cable slings occupy an important place in hoisting, and have been found satisfactory when carefully used. A wire-cable sling should never be used singly when hooked by a spliced eye. When the weight is sufficient the cable is likely to untwist, thus allowing the splices to open and slip. Such slings should always be used double, and where sharp corners or rough castings exist the cable should be protected by pads. Another method of protecting the cable is by two loose metal blocks that should be perfectly free to adjust themselves and afford ample protection for the slings so used.

In using slings of any kind, especially rope, care should be taken to see that they are properly laid; that

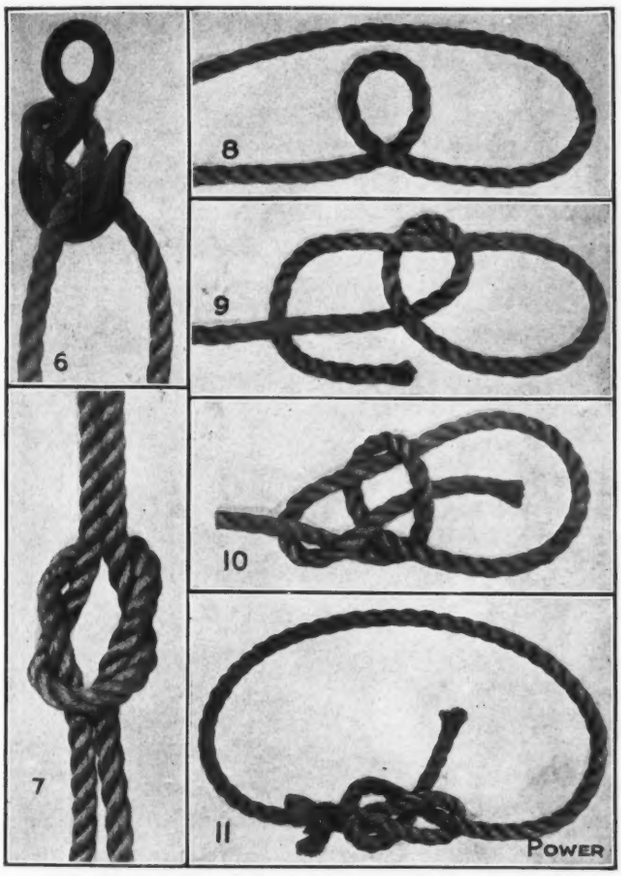


Fig. 6. Blackwall hitch, especially useful for hauling material on the level. Fig. 7. Square or reef knot used only for joining two ropes together. Figs. 8, 9 and 10. Steps in making a bowline knot. Fig. 11. Sheet bend in eye, generally used for an adjustable sling.

is, to see that one rope does not lie on top of the other, as this will prevent proper equalization, putting an undue strain on the outer rope. It often happens, when a rope sling is used double, that the ends of the rope are passed through the doubled part, and unless this is done carefully, instead of having the strength of two parts of a rope, as supposed, it can be so slipped around the casting, or other piece being lifted, as actually only to have the strength of one part.

Before lifting heavy loads by means of a crane the crane brakes should always be tested to see that they are in good condition and will hold. Care must be used when lowering loads to limit the speed, which should not exceed the hoisting speed of the crane for the same load. Particular care must be taken to apply the brakes gradually when bringing the load to rest. Stopping the load at speeds of 12 to 18 ft. per min. within a distance of 1/8 in. may double the stress on the slings and crane.

When a weight is lifted by two or more slings connected to the crane hook and making an angle with each other, the increase in the stress of the individual slings must be considered. On account of this angle between the two sets of slings the stress on each set is greater than half the total load, and increases very rapidly as the angle between the sling and the work is decreased. An angle of 45° between the sling and the work, as in Fig. 21, makes the stress in each sling three-fourths of the total weight, and the collapsing force between the two points of attachment to the work is equal to half the weight. This collapsing force acts in a direct line between the two points of attachment.

A spreader of sufficient stiffness should be used between these two points in the manner illustrated in Fig. 22, to resist this collapsing force. It will be seen that eye-bolts are not suitable for attaching the slings to the work unless a spreader is used to relieve them of this side pull, which would put a heavy bending moment on the shank of the bolt. Reducing the angle between the sling and the work to 30°, shown in Fig. 20, makes the stress in each sling equal to the total weight, and the collapsing force is also equal to the total weight. Such a small angle should never be used if avoidable.

Safe Loads for Eye-bolts, Ropes and Chains

When it is necessary to use eye-bolts for lifting loads, no greater strain should be allowed than given in Table 1, which gives the safe load in pounds for bolts up to and

TABLE 1. SAFE LOADS FOR EYE-BOLTS

	Inches A	Inches B	Inches C	Safe Load, Lb.
Drop-forged steel	1/2	1 1/4	7/16	1,100
	5/8	1 1/2	17/32	1,500
	3/4	1 3/4	5/8	1,800
	7/8	2	3/4	2,800
	1	2 1/4	13/16	3,900
	1 1/4	2 3/4	1	5,100
	1 1/2	3 1/4	1 1/16	8,400
	1 3/4	3 3/4	1 1/4	12,200
	2	4 1/4	1 3/8	16,500
	2 1/4	4 3/4	1 1/2	21,800
D.B.G. iron E.L., 28,000 lb. per sq.in., welded	1 1/2	3	1 1/4	10,000
	1 3/4	4	1 1/2	11,000
	2	5	1 3/4	14,000
	2 1/4	6	2	16,000

including 2 1/4 in. in diameter. It should be noted that the values given are correct only when the pull is in the direction of the arrow shown in Fig. 14, and when the bolt is in good condition.

It should be understood that, to obtain the greatest strength from an eye-bolt, it must fit reasonably tight in the hole into which it is screwed, and the pull applied in a line with the axis of the screw. Eye-bolts should never be used if considered the least faulty. They should never be painted when used for miscellaneous lifting, as paint is very apt to cover up flaws. They should be tested occasionally by tapping gently with a hammer, but not sufficient to bend or to otherwise injure them. If they do not impart a good ring one of two things is the reason. They may fit too loosely in the hole, or there may be a flaw.

Where a bolt is to be used for anything like its maximum load it should be screwed in tight with a bar and given a gentle tap with a bar or hammer to see if it imparts a solid feeling. If not, it should not be used.

Table 2 gives the safe loads which may be put on manila rope, wire cables, and chains. The first column gives the diameter of the rope or chain, the second col-

umn gives the safe load which the rope or chain is to carry singly. In a sling where the strain is carried by two ropes or chains, the loads given in the third column should be used. In a sling where four parts of the rope or chain carry the load, the figures in the fourth column should be used. Figures are in tons of 2000 lb. each. The loads for manila rope should be used only when the rope is in fairly good condition.

A wood or lag screw, when made in the form of an eye-bolt, should never be used to hang any hoisting tackle on. Wherever possible the safest way to hang such tackle is by passing the shank of an eye-bolt through the floor or beam, properly protecting the wood by a large plate washer and nut. It frequently happens that a chain or rope sling can be used by passing it over a properly secured timber. There are several good ways of doing things, and many wrong ways.

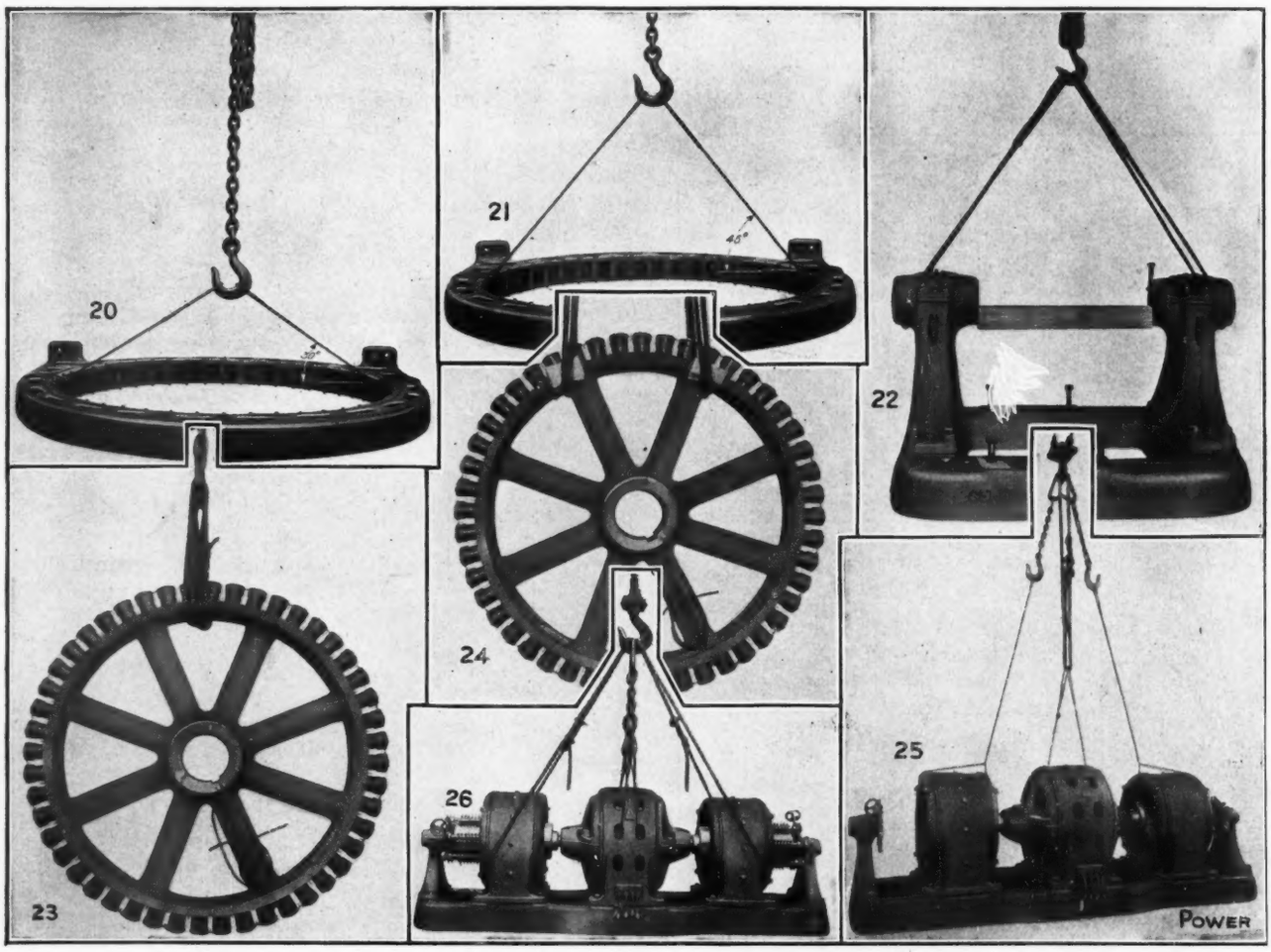


Fig. 20. 30-deg. angle sling (wrong way). Fig. 21. 45-deg. angle sling (right way). Fig. 22. Lifting a base with standards with provision for lateral srains. Fig. 23. Lifting revolving field (wrong way). Fig. 24. Lifting revolving field (right way). Figs. 25 and 26. Wrong and right ways of lifting motor-generator sets.

TABLE 2. SAFE LOADS ON ROPES AND CHAINS

Manila Rope, Safe Load in Tons				Wire Cable, Safe Load in Tons				Chains, Safe Load in Tons			
Diam. of Rope, In.	Single Rope	Two Part	Four Part	Diam. of Cable, In.	Single Rope	Two Part	Four Part	Diam. of Chain, In.	Single Chain	Two Part	Four Part
¼	¼	½	¾	½	1	2	3½	¼	½	¾	1½
⅜	½	¾	1	⅝	1½	3½	6½	⅜	1	1½	3
½	¾	1	1½	¾	2½	4½	9	½	2	3½	6
⅝	1	1½	2	⅞	3½	6	12	⅝	3	5	9
¾	1½	2½	3	1	4	8	16	¾	5	9	15
1	2	3	4	1¼	6	12	24	⅞	6	10½	18
1¼	3	4	6	1½	10	19	36	1	8	14	24
1½	4	6	8	1¾	13	25	48	1¼	11	19	33
1¾	5	8	11	2	16	32	60	1½	13	23	39
2	6	9	13					1¾	18	32	54

Copper in Japan

The 1912 production marks a further considerable advance in Japan's copper industry. According to the estimate of the official mining bureau, the output totaled about 62,000 tons, but reliable private reports put it at 66,000 tons, against 55,000 tons in 1911 (*Min. Journ.*, Apr. 26, 1913).

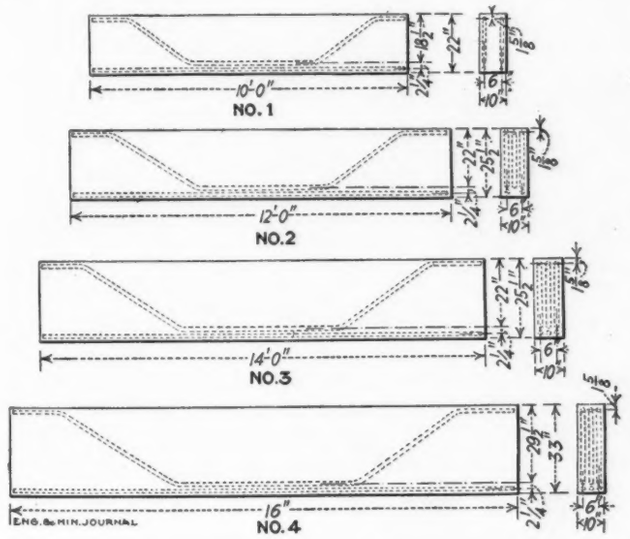
The existing copper mines increased their ore output from 10 to 30%. Furthermore, a number of new mines and smelteries have opened in 1912. Among them the Hanaoka mine (production 500 tons) and the Abeshiro mine (production 400 tons), are the most important. Both are situated in the north. Japan's copper export in 1912 amounted to 38,370 tons, while the home consumption absorbed 27,630 tons, or 11,000 tons more than in the preceding year.

DETAILS OF PRACTICAL MINING

Concrete Beams for Underground Use

A timberman used to working with wood and able to judge with fair accuracy the proper size of timber for supporting any one piece of ground is apt to be rather at a loss when called upon to judge the amount of concrete necessary for the same job. In order to guide the timberman in such work, C. G. Mason, engineer of the Baltic mine, designed the standard concrete beams herewith illustrated and specified the timbers to which they would be equivalent in strength. The timbermen were thus able properly to proportion the beams and distribute the reinforcement and to select the dimensions equivalent to the timber which their judgment selected for the job in hand.

Beam No. 1 contains four 1¼-in. wire ropes spaced as shown. It is equivalent to a timber 10x16-in. by 10-ft.



REINFORCED BEAMS FOR UNDERGROUND USE

The uniform load for either timber or beam is assumed at 2275 lb. per running foot, thus allowing a safety factor of four. Longer timbers or beams of the same section would have the safe load decreased, this being for a 10x16-in. by 16-ft. beam about 900 lb. per running foot.

If it were necessary to main the strength so as to withstand a running load of 2275 lb. per ft., the depth of section would be increased for the increasing spans and the reinforcement added to. Thus for a 12-ft. span loaded at 2275 lb. per ft., beam No. 2 would be used. This contains five 1¼-in. reinforcing ropes; for a 14-ft. span, beam No. 3 would be used containing six 1¼-in. reinforcing cables; and for a 16-ft. span, the dimensions of beam No. 4 would be proper, this design also including six 1¼-in. cables.

The material used in the reinforcement was discarded hoisting rope. It was found that there was no shearing of the bond between the cable and the concrete, as the hoisting operation had taken all the stretch from the cables, making them as efficient as bars.

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Hoisting Ropes in Actual Performance

The characteristics, life and work of a series of 30 hoisting ropes, each 1⅜ in. in diameter, have been compiled in tabular form by the Robinson Deep Gold Mine, Ltd. The table is published in the *Journal* of the South African Institution of Engineers, January, 1913. Of the 30 ropes, 24 completed their services and a study of the figures presented for these, yields some interesting results. As soon as the factor of safety for any rope fell below six, it was discarded. This was the fate of 22, the other two being thrown out as the result of accidents. The ropes, while all round, were of different types of construction, 19 of them, however, being of Lang's six-strand, 19 wires to the strand, type. The diameters of the wires ranged from 0.072 to 0.125 in. and their aggregate area varied from 0.6897 to 0.735 sq.in. The steel was all of a high tensile strength, the breaking strength varying from 235,200 to 280,000 lb. per sq.in. with an average of 259,500 lb. The aggregate strength of the wires varied from 169,000 lb. to 212,192 lb. with an average of about 191,200 lb. In no case was the aggregate strength of the wires found to be lower than that certified by the maker. It was in one case as much as 15.8% higher, the average excess being 7.2%. After six months' use, 16 of the ropes were tested in the laboratory, and the reduction in breaking strength, from the aggregate strength of the wires when new, was found to vary from 9.3% to 33.5%.

The loads including the weight of the ropes ranged from 16,960 lb. to 26,310 lb. Based on this load, and the maker's certificate of strength, the safety factors averaged 8.15 when new, varying from 6.35 to 11.2. The weights ranged from 2.84 to 3.16 pounds per foot.

Great variation is shown in the performance of the various ropes, neglecting the two rejected because of accident; their working life ranged from 139 days to 706 days; the work done in foot-tons shows a minimum of 341,058,789, and a maximum of 1,551,805,722; and the distance run shows a minimum of 13,702 miles and a maximum of 80,860 miles. Various prices were paid for the ropes and the cost per foot-ton hoisted, extends over wide limits, the lowest being 0.0000824c. and the highest 0.000356c. It is to be noted that the lowest cost was got with a medium-priced rope and both the cheapest and the most expensive gave only mediocre service.

The rope which gave the highest cost per foot-ton was a Lang's six-strand, 19-wire rope, the wires having individual diameters of 0.092 in. and an aggregate area of 0.7578 sq.in., giving a strength of 203,705 lb., the steel having a breaking strength of 268,800 lb. per sq.in. It carried a load of 25,874 lb.; had a low safety factor, 6.9; and was heavy, 3.16 lb. per ft. It cost about $1.18 per yd.

and lasted only 162 days, giving an output of 341,058-789 foot-tons with a run of 13,702 miles, 0.000356c. being the cost per foot-ton. The two ropes which had the shortest life were identical, of Lang's six-strand, 19,-wire type, with a total wire area of 0.7417 sq.in., two diameters of wire being used, 0.114 in. and 0.076 in. The steel had a strength of 257,600 lb. per sq.in. and the aggregate strength of the wires was 191,062 lb. The load was only about 17,000 lb., so that the initial safety factor was high, 11.2. The ropes were rather heavy, 3.034 lb. per ft., but were the cheapest ropes bought, costing only about $0.99 per yd. They gave outputs of 479,297,244 foot-tons, running only 21,790 miles, at a cost of 0.0001708c. per foot-ton.

The very best performance was obtained with a rope still in use and not heretofore considered in this discussion. This was of Lang's six-strand, 19-wire type, the individual wires having a uniform diameter of 0.094 in., or a total area of 0.7912 sq.in. The steel was of high tensile strength, 274,000 lb. per sq.in., and the aggregate strength of the wires was 216,789 lb., this being a higher figure than any previously given. After six months' use, this strength was 177,760 lb., a reduction of 35%. The load was heavy, 26,979, and the initial safety factor low, 7.08. The rope was heavy, 3.3 lb. per ft. The rope had worked only 357 days, but had hoisted 1,669,935,634 foot-tons in a travel of 57,488 miles, at a cost of 0.000073c. per foot-ton, the first cost being $1.24 per yd.

Apparently the load has a less deleterious effect on a rope's life than has the mileage run. The effect of bending, of course, enters into this. The lowest cost per foot-ton, so far as can be judged, is got with a high class, heavy rope, carrying a heavy load, and working steadily. It is regrettable that the sheave and drum sizes and the number of bendings are not given in order to judge of the effect of bending on the rope's life, but nevertheless, the information conveyed is of the greatest value.

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Selection of Explosives

The characteristic features of the principal blasting explosives and their suitability for different classes of work are covered in *Bulletin* 48, "The Selection of Explosives Used in Engineering and Mining Operations," prepared by Clarence Hall and Spencer T. Howell, and issued by the U. S. Bureau of Mines. This bulletin is one of a series published on explosives. It states that the explosives for any particular work should be selected with care. In underground work the character of the gases evolved is important. In coal mines the safety of the explosives, as regards possible ignition of gas or dust, should be considered. In wet workings or for submarine blasting, resistance to moisture is an essential feature. In cold climates a low freezing point is an advantage. Explosives, especially those for use in tropical climates, should remain stable under all climatic conditions.

The methods of manufacture, typical composition, and special fields of the following well known explosives are treated: Black blasting-powder, granulated nitroglycerin powder, "straight" nitroglycerin dynamite, low-freezing dynamite, ammonia dynamite, and gelatin dynamite. Black powder is suitable where a heaving effect is desired. Granulated nitroglycerin powder has a similar action, but is superior in soft or seamy rock. Straight nitroglycerin dynamite gives a high disruptive force. The action of low-freezing and ammonia dynamites is slower. Ammonium nitrate being deliquescent, the ammonia powders are not suitable for wet work. Gelatin dynamites are excellent for wet blasting and also produce the smallest percentage of poisonous gases. A special gelatin dynamite was made for the bureau, which produced no poisonous gas whatever, and would seem to offer important suggestions along the line of fume elimination.

The bulletin closes with a table showing the relative potential energies, disruptive effects and propulsive effects of mine explosives of different classes and grades.

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Simple Joplin Headframes

The typical Joplin headframe for small installations is of the four-post type, shown well in Fig. 1. Since the drum of the whim or steam hoist is placed within or near the line of the posts, there is no need of the A-type of headframe. The hoistman must be near the collar so as to dump the bucket as well as run the hoist. His presence there, combined with the fact that the loads are light, the hoists small and the speeds slow, reduces the necessary allowance for overwinding so that 16 ft. above

FIG. 1. UNHOUSED HEADFRAME WITH WHIM

the ground or landing floor is all that is required for a steam hoist, and for a whim, four or five feet only is necessary, as the whims are of a type which allows the drum to be thrown out of clutch with the tumbler-drive at any time, thus stopping the rope without stopping the horse.

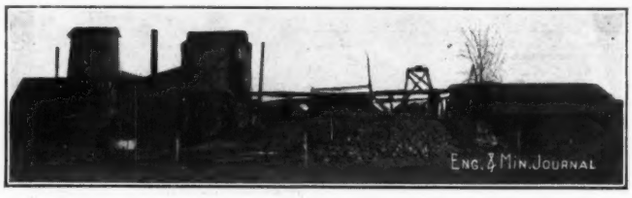


FIG. 2. TYPICAL LAYOUTS FOR STEAM HOISTS

When a steam hoist is installed, the boiler is set in a lean-to at the rear of the headframe. The top of the headframe is usually boarded in as seen in Figs. 2, 3 and 4, as soon as the danger of rocks flying out of the shaft ceases. This housing gives additional stiffness to the structure. The smaller headframe in the foreground of Figs. 3 and 4, is used to work the shallow lead deposits that overlie the zinc. Such a small headframe as well as that in Fig. 1 has its corner posts built of 2x6-in. planks nailed together to form a trough. Diagonal braces may be of 2x4-in. stuff. The upper floor is carried on 2x6-in. planks nailed to the corner troughs and the top cross-braces are of doubled 2x6-in. planks similarly nailed. The sheave is carried between two round oak poles about five

inches in diameter and flattened at their ends to rest on the top crossbraces. Timbers, 6x6 in., may be substituted. If a steam hoist is used, the crossbraces carrying the sheave timbers are braced with diagonal 2x6-in. planks.

The manner of setting the whim drum and the whim itself can be seen in Figs. 1, 3 and 4. In Fig. 3 can be seen the lever by means of which the whim is controlled from the platform above. A typical bucket for small-scale work can be seen in Fig. 4. This is made of half an oil barrel and holds about 350 lb. For deeper shafts a steel bucket holding 500 lb. is more common. For handling such buckets, the box arrangement at the end of the trestle in Fig. 1 is used.

In the more elaborate structures, the steam hoist is mounted on four "Samson" posts, independent of the frame itself, to relieve the latter of vibration. These can be seen in Figs. 3 and 4 in the larger headframe in the background. Such a headframe as this is the type adopted for hoisting about 200 tons of zinc per day.

Fig. 2 shows two complete installations, also using the heavier headframes. The one in the rear, with its battered superstructure, is the more characteristic. In such frames, as well as the larger one of Figs. 3 and 4, the corner posts are of 8x8-in. timber.

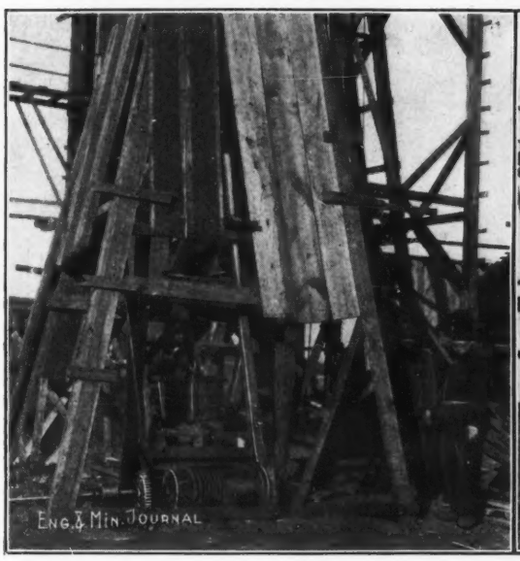


FIG. 3. ARRANGEMENT OF WHIM DRUM AND CONTROLLING LEVER

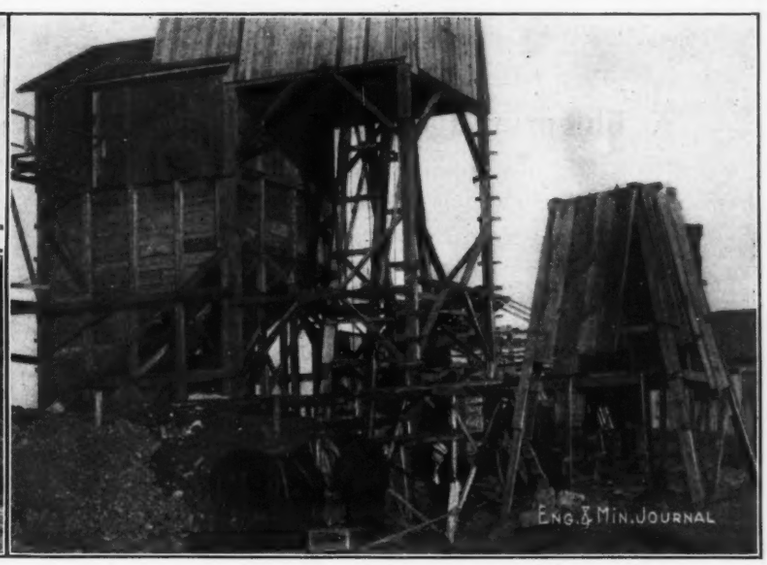


FIG. 4. LARGE AND SMALL HEADFRAMES FOR STEAM AND WHIM HOISTS

Constructing a Flume Trestle

The trestle in question was constructed to support a corrugated-steel irrigation flume passing over a gulch. The method of construction and the cost are given by A. M. Korsmo in *Engineering Record,* Apr. 5, 1913. The trestle was 564 ft. long, with a maximum height of 96 ft. It was built of rough Oregon fir, No. 1 common, which was of good quality and fully dimensioned. The bents were spaced 23 ft. 6 in. center to center, and had a batter of three in 24. They were anchored by iron straps to concrete piers one foot square and 18 in. high. The posts were of 6x6-in. material, the braces of 6x6-, 3x6-, 2x8- and 4x8-in. stuff. Stringers 4x8 in. carried 4x4-in. cross-pieces, upon which the flume was supported. Instead of erecting one set at a time, using considerable false-work, a cantilever-erecting beam was built to slide along the top of the completed structure, and each bent was completed as the work advanced. The operation covered a period of 15 days, with a crew of seven laborers, four carpenters and a foreman. The lumber consumed amounted to 27,900 b.ft., and the cost of labor was as follows: Laborers, at 25c., $193.75; carpenters, at 35c., $227.15; foreman, at 45c., $66.60; mule, at 10c., $15; giving a total of $502.50, or about $18 per 1000 ft., board measure.

Shafts Sunk with Plugger Drills

The recently completed shafts of the Christopher Coal Mining Co., Christopher, Franklin County, Illinois, were sunk by hand-feed hammer-drills of the Sullivan class "DB-19" pattern, using 1-in. hexagonal hollow steel with 6-point rose bits, and operated by air at 80-lb. pressure by a single-stage air-compressor, having a capacity of 130 cu.ft. of free air per minute. Air was furnished the drills by a 3-in. pipe, which has been left in the shaft to serve as a conduit for signal wires.

Two shafts were sunk by this process according to R. J. Kirkpatrick in *Mine & Quarry,* April, 1913, the main shaft, 13x21 ft. in the clear, the air shaft 12x24 ft. The first of these was commenced May 27, 1912, and reached the coal Nov. 27, 1912, 593 ft. from the surface. The air shaft was started a few days later and reached the coal in practically the same length of time. The formations penetrated varied from soft shale to hard limestone and flint.

The drilling round consisted of 18 holes, averaging eight feet deep, and large enough for 1¼-in. powder at the bottom. Four machines were used at once, and the average time required was 20 min. per hole. When the drilling was completed, the drills were taken to the other shaft and a round put in there. Six holes formed the cut, and these were fired first and the muck removed. Then six "sumpers" were loaded and fired, and finally six end holes for squaring up, making three shots per

round of holes. The rate of advance was slightly more than seven feet per round.

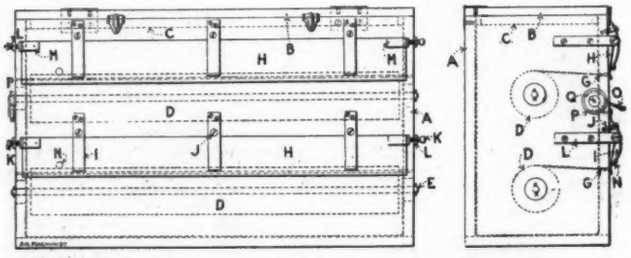
A lining of concrete and steel was placed as the sinking progressed, making the shafts fireproof. The air shaft is provided with a steel stairway, and a 24x36-in. first-motion hoist for lowering men and materials.

The main shaft will be equipped with what is said to be the largest electric mine hoist in America. It is driven by a 1150-hp. 550-volt direct-connected motor, operates on the Ilgner system, and is designed to make 1000 trips from a depth of 600 ft. in seven hours, with an effective load of 9000 lb. The speed and direction of rotation will be controlled by the Ward-Leonard system, and protective devices will be installed to guard against overwinding, failure of current supply, loss of exciter voltage, failure of brakes, or extreme overloads.

Power for all operations above ground will be furnished by two 750-kw. three-phase, 60-cycle, 2300-volt turbo-generators, three 300-kw. synchronous motor-generator sets being used to supply a 275-volt direct current for underground use. The power plant includes five 600-hp. vertical boilers, with automatic stokers and revolving grates. All electrical apparatus is furnished by the General Electric Company.

A Blueprint Paper Cabinet

The blueprint cabinet shown in the engraving protects the paper from the light and air and can be easily and



BLUEPRINT PAPER HOLDER AND CUTTER

economically handled, writes V. J. Halter, *American Machinist*, Apr. 3, 1913.

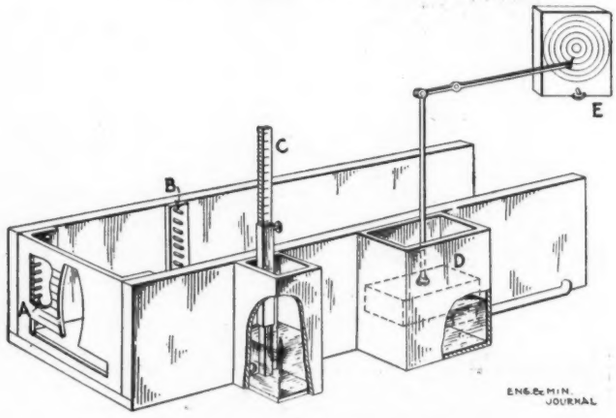
The cabinet *A* is made of wood about ¾ in. thick, with a hinged lid *B* locked by two catches. Underneath the lid is a felt packing *C*, upon which the lid rests, thereby insuring perfect contact with the cabinet. The cabinet has been built for two weights of paper, but by building higher, three or more qualities can be accommodated. The rolls *D* are held on the rods *E*, which have bearings in steel bushings driven in the cabinet.

The paper is drawn through the slots *G*. The blade *H*, with the knife edge, covers the slots and clinches the paper. A spring pressure against the blade is provided by the springs *I*, and an adjusting screw *J* regulates the tension. The blades swing on the pivots *K*, which are $\frac{5}{16}$-in. machine screws, pointed and screwed in the bearings *L*.

The pivot points project into the steel pieces *M*, riveted to the blades. When paper is required, the knob *N* is grasped and the blades are lifted, allowing the paper to be drawn through the slot. When enough has been taken, the paper is drawn against the edge of the blade and cut off. A steel tape *O* is provided on one side of the cabinet and inclosed in a tin case *P*, the top of which is perforated with a 1-in. hole. The tit *Q* should be placed against the cabinet, so that when the opposite side of the tape case is pressed against, the tape will rewind.

Improved Miner's-Inch Measuring Device

A box which combines some features of both the miner's inch and the weir methods of measuring water, has been invented by William F. Englebright of Nevada City, Calif. (U. S. pat. 1,042,097.) Its object is to conduct the water to be measured through an opening of such shape that the volume flowing varies directly with the head on the opening and can be got by multiplying this head by a constant factor. In the miner's-inch system of measurement, the water is allowed to flow through a submerged opening. The flow in such a case will vary about as the square root of the height of water above the opening. Consequently the determination of the volume passed through involves calculation often incovenient or impossible for those concerned. In the case of weir measurement, the flow varies as the square root of the cube of the head of water on the weir. Obviously the



MEASURING BOX FOR WATER

flow increases in the first case at a rate less than the rate of increase of the head, and in the second case, at a greater rate. By combining the two methods, is should be possible to obtain a flow which would increase at the same rate as the increase in head. This is the object of the present invention, the principal features of which are shown in the drawing.

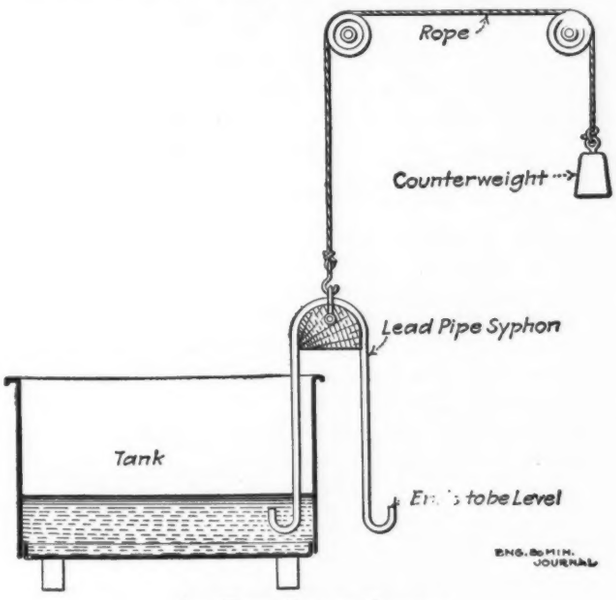
The opening for the water is an inverted T with the sides of the stem curved. Its configuration is so calculated as to bring about the desired effect on the flow, as the height of water varies. The height or the volume may be read approximately on gage plates as at *A* or *B*, or it may be measured with some exactness by the hook-gage *C*. A third possible method consists in the use of the float *D* connected through a stem and lever to mark on a revolving, recording dial *E*, and thus give a complete automatic record of the rate of flow at all times.

Tar as a Covering for Iron Work must be used with great care, inasmuch as the crude material contains sulphuric acid and ammonia. This may cause serious pitting and rusting, according to the "Engineer," Mar. 7, 1913. Furthermore, it does not adhere well to bare metal and should never be applied except as a covering for other pigments. The refined product offers the advantage of great resistance to foul atmospheres and corrosive gases. On account of its dark color the presence of rust cannot be easily detected.

DETAILS OF METALLURGICAL PRACTICE

An Ever-Ready Siphon

A contrivance suitable for siphoning clear liquid from an acid-treatment tank, or similar uses, is described by P. T. Morrisby (*Journ.*, Chem., Met. and Min. Soc. of So. Afr., February, 1913). It consists of a pipe of iron or lead, preferably the latter, long enough to reach one leg to the bottom of the tank. This is bent in the middle over a semicircular block of wood, and the two ends of the pipe are turned up, as shown in the drawing. A rope and counterweight allows convenient movement. After



AN EVER-READY SIPHON

the original priming of the device, under pressure, it remains primed and is always ready for use. Beside its application in connection with the acid-treatment tank, it is serviceable for other minor operations about the plant, such as removing clear liquor from settled precipitate, emptying zinc-box compartments, and other similar uses.

⁂

Proportions of Concrete in Practice

As a rough guide to the selection of materials for various classes of work, four proportions are suggested by Taylor & Thompson in their book "Concrete Costs"; they differ from each other only in the relative quantity of cement:

(1) A rich mixture for columns and other structural parts subjected to high stresses or requiring exceptional water-tightness, should have the proportions, 1 : 1½ : 3; that is, one barrel (four bags) of packed portland cement to 1½ bbl. (5.7 cu.ft.) of loose sand to three barrels (11.4 cu.ft.) of loose gravel or broken stone.

(2) A standard mixture for reinforced floors, beams, and columns, for arches, for reinforced engine or machine foundations subject to vibrations, for tanks, sewers, conduits and other water-tight works, should have the proportions, 1 : 2 : 4; that is, one barrel of packed portland cement to two barrels (7.6 cu.ft.) of loose sand to four barrels (15.2 cu.ft.) of loose gravel or broken stone.

(3) A medium mixture for ordinary machine foundations, retaining walls, abutments, piers, thin foundation walls, ordinary floors, sidewalks and sewers with heavy walls, should have the proportions 1 : 2½ : 5; that is, one barrel of packed portland cement to 2½ bbl. (9.5 cu.ft.) of loose sand to five barrels (19 cu.ft.) of loose gravel or broken stone.

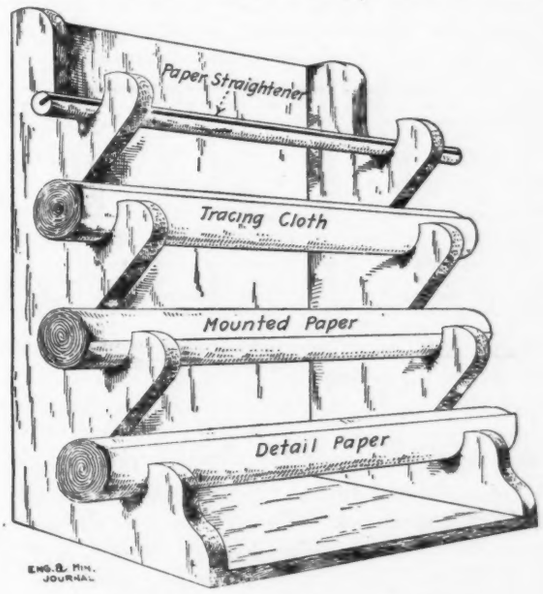
(4) A lean mixture for unimportant work in masses, for heavy walls, for large foundations supporting a stationary load, and for backing for stone masonry, should have the proportions, 1 : 3 : 6; that is, one barrel of packed portland cement to three bbl. (11.4 cu.ft.) of loose sand to six bbl. (22.8 cu.ft.) of loose gravel or broken stone.

These specifications are based upon fair average practice. If the aggregate is carefully graded and the proportions are scientifically fixed, smaller proportions of cement may be used for each class of work.

⁂

Handy Rack for Paper Rolls

The accompanying drawing illustrates a rack recommended by R. W. J. Stewart in the *American Machinist*, Apr. 24, 1913, for storing drawing papers in the office. The device on the top rack is a paper straightener which consists of a turned maple stick one inch in diameter

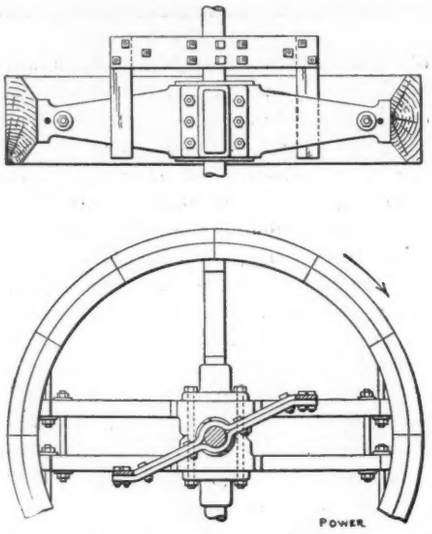


OFFICE RACK FOR ROLL PAPER

and 36 in. long, with a longitudinal saw cut for its full length. By slipping it over the end of the piece of paper cut from the roll and rolling the paper in the reverse direction, the curl can be taken out of the paper without breaking it.

Repair on Slipping Pulley

A large split wooden pulley which gave much trouble, due to slipping on the shaft was made to operate satisfactorily by means of a separate clamp as shown in the illustration. This was securely fastened to the shaft next to the hub of the pulley. Two strips of hardwood



AUXILIARY CLAMP TO PREVENT SLIPPING OF PULLEY

were then bolted to the clamp at each end and projected into the pulley so as to bear each against the opposite sides of the pulley frame. The arrangement works well, according to Frederick L. Johnson in *Power*, Apr. 29, 1913, and the normal load is carried without fracture to the clamp.

Holes for Bunsen Burners

The accompanying table, by John Kenan (*American Machinist*, Apr. 15, 1913), gives proportions of pipe and the size and number of holes used in making Bunsen burners. These have been found useful in making burners for embossing presses and other similar uses.

Size of Burner	Number of holes (Burner to be any length). ¼" Drill	5/32" Drill	3/16" Drill	7/32" Drill	¼" Drill	9/32" Drill	5/16" Drill
⅜"	2	3	4	5	9	16	36
½"	4	5	7	10	16	28	65
¾"	9	12	16	23	36	64	146
1 "	16	21	28	41	64	114	260
1¼"	25	33	45	64	100	178	507
1½"	36	47	64	92	144	256	586
2 "	64	83	114	165	255	455	1000

A good proportion for close distance between holes is three times the diameter of hole. (Sizes of burner given are pipe sizes.)

The burner should be so placed that point of flame will just lick underside of surface to be heated. A good range of distance between top of burner and under surface to be heated is from 1 to 1½ in.; this, however depends on gas pressure. Mixing chamber should be five times diameter of pipe from orifice to first hole

Electric Zinc Smelting

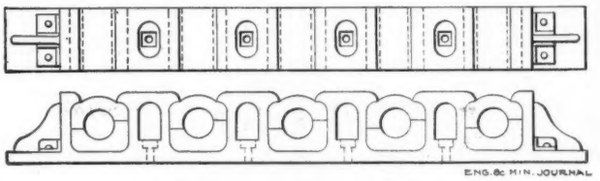
According to C. Lourdier in *La Technique Moderne*, No. 5, 1913, the Cote & Pierron method of electric zinc smelting has been introduced in a works at Ugine (Savoy), which is the largest plant yet constructed for this process. The Cote & Pierron process is based upon the direct reduction of zinc sulphide by metallic iron. The furnace at Ugine is of the arc-resistance type, having an upper carbon electrode 0.5 m. in diameter, the furnace bottom serving as the lower electrode. The furnace is of 400 kw. capacity, using alternating current of 52 to 56 volts. The zinc vapor is condensed in a column of charcoal. In a trial run lasting 72 hr., 9560 kg. of blende, assaying 34.8% zinc, mixed with 2970 kg. of iron yielded 2180 kg. of spelter assaying 99.06% zinc. These figures show an extraction of about 66% of the zinc of the ore and a consumption of 0.90 kg. iron per 1 kg. of zinc, the theoretical requirement being 0.86 kg.

Auxiliary for Bucket Elevator

In order to permit short shutdowns for making repairs on a bucket elevator, an auxiliary is provided in the No. 3 mill of the Doe Run Lead Co. of Southeastern Missouri. A pit was constructed next to the main elevator pit and lower than it so that when repairs are necessary the material in the latter can be run out and into the auxiliary, thus permitting a man to enter and work. Another small elevator works in this auxiliary and when the repair job is done and the main elevator in motion again the material in the lower pit is lifted once more to the main pit. The auxiliary elevator is run by a small belt from a projection on the shaft of the main bottom pulley to the top pulley of the auxiliary.

Stamp-Stem Guide

A guide for stamp stems which has met with favor among millmen is the design known as Ideal. This consists of a cast-iron frame holding five split journals, the outside of which is formed in wedge shape, substantially as shown in the accompanying drawing. The advantages are that no bolts or screws are used in the journals and



A GUIDE FOR STAMP STEMS

they can be put in or taken out by hand whenever required. The wedge shape allows wear of the stem in the journal to be taken up automatically. The device is made by G. W. Myers, of San Francisco.

Selection of Sand for Concrete

The two most essential qualities to consider in sand are cleanness, that is, freedom from impurities, and coarseness of the grains. The sharpness of the grains and the mineralogical composition, according to "Concrete Costs," by Taylor and Thompson, while affecting to a slight extent the strength of the mortar for concrete, are not in themselves sufficient for accepting or rejecting a sand.

Cleanness, meaning by this not so much freedom from fine clayey material as freedom from vegetable matter, is of prime importance, since such impurities may so affect the strength of the mortar as to make even a well graded sand absolutely dangerous to use. The fineness of the sand and its percentage of silt passing a sieve having 100 meshes per linear inch, may also be a ground for rejection, since a fine sand always makes a weak mortar or concrete.

THE COST OF DOING THINGS

Nipissing Mines Co.

The Nipissing Mines Co., Cobalt, Canada, states in its annual report for 1912 that the cost of producing 4,688,260 oz. of silver was 17.39c. per oz. This cost was made up of 12.08c. for general operating expenses including explorations, sorting, loading, etc.; 2.12c. for milling high-grade ore, 0.66c. for milling low-grade ore, 1.12c. for depreciation, 0.87c. for custom milling, 1.31c. for marketing, 0.3c. for corporation expense, a total of 18.46c. less a credit of 1.07c. for rents and interest received. The cost of production equaled 28.14% of the gross value of of the ore produced.

In previous years, prospecting on the surface for vein outcrops has been carried on by surface trenching, the cost of which has been given in the JOURNAL of Apr. 13, 1912, p. 741. Prospecting is now carried on by a hydraulic plant recently installed. Water is furnished by a turbine pump situated on Cobalt Lake, throwing 4800 gal. per min. under a 415-ft. head at the pump and is direct connected to a 650-hp. high-speed motor. The operation consists of stripping the surface of soil and boulders by a stream of water directed through a 3.5 or 4-in. nozzle with 121 lb. pressure at the nozzle. The plant was in operation from May 8 to Nov. 29, 1912, without serious interruption, for 16 hr. per day. During this time 33.2 acres of ground were cleared of soil, the average depth being 4.75 ft. Referring to the statement of expenses the cost of hydraulicking and clearing land is given at $19,292. This would indicate that the average cost was $581 per acre or 7.56c. per cu.yd. of material removed.

North Butte Mining Co.

The 1912 annual report of the North Butte Mining Co., Butte, Mont., states that 425,248 dry tons of ore were treated, yielding 26,480,123 lb. of refined copper, 1,377,468 oz. of silver and 1367 oz. of gold. This gives an average yield of about 62 lb. of copper per ton of ore. The net cost of copper was 9.652c. per lb. of which mining and development was 6.977c.; freight on ore, 0.197c.; concentrating and smelting, freight and selling bullion, 5.689c.; construction, 0.08c. and general expenses, 0.083c. with a credit of 3.374c. per lb. of copper for gold and silver. The mine was operated 342 days and hoisted an average of 1269 tons a day with 902.5 men, which is equivalent to 1.4 tons per day per man employed. The development work included in mining amounted to about one foot for every 24 tons of ore mined.

Zinc Mining Costs at Joplin

The following costs were extracted from an article, "Mining Costs in the Joplin District," by Charles W. Burgess, published in the *Colorado School of Mines Magazine*, April, 1913. Some ore has been found at shallow depth in the district, but the largest production comes from 140 to 200 ft. The cost of mining and milling per ton of crude ore varies from 82c. to $1.25, and it is stated that a fair average is about $1 per ton. Prospecting is done by churn drilling, and contracted for at 90c. per ft. Holes are usually drilled to a depth of 200 to 250 ft., and in prospecting a 40-acre lease 15 holes to an average depth of 200 ft. are considered sufficient. The average wage scale in the district is as follows: Blacksmith, hoisterman, machine men, and pumpmen, $2.50 per shift of eight hours; machine-man helper, $2.25 and drillmen, $2 per 8-hr. shift; crusher feeders, $2.25, and jig helpers and engineers, $2.50 per 10-hr. shift. Ore is shoveled into cans varying in capacity from 800 to 1200 lb. per can. Shovelers are paid from 5 to 9c. per can, depending upon the size of can and length of haul. Ground bosses get from $25 to $35 per week and head jigmen from $25 to $30. The total cost of all labor is from 53 to 58% of total operating cost.

Mine run of coal costs from $2.25 to $2.65 per ton. Gas costs from 12½ to 15c. per 1000 cu.ft. Electric current is furnished at $1.25 per hp. connected per month as an installation charge, and 1⅛c. per hp.-hr. for current used with discounts. The concentrates are sold to competitive bidders on the basis of 60% metallic contents. A premium of $1 is paid for each per cent. above 60%. A penalty of $1 is made for every per cent. of iron over

TABLE OF COSTS OF MINING AT TYPICAL JOPLIN DISTRICT MINES

Name of Company	Alba Federated	Neck City Federated	Webb City Federated	Diplomat	S. V. & D. Mine	Mattes Mine	Kramer	Calhoun
Character of ore body	Soft	Disseminated	Sheet	Sheet	Soft	Sheet	Disseminated	Sheet
Tonnage of mill in 10 hours	95	200	200	250	200	250	450	300
Pumping required	Light	Heavy	Heavy	Heavy	Heavy	Medium	Light	Medium
Heights of drifts	12 to 14 ft.	25 to 35 ft.	16 ft.	12 to 14 ft.	10 to 12 ft.	7 to 10 ft.	12 to 40 ft.	14 to 16 ft.
				COSTS PER TON OF ROCK				
Superintendence	0.021	0.009	0.010	0.012	0.011	0.033	0.029	0.014
Surface labor	0.157	0.147	0.176	0.127	0.138	0.160	0.171	0.158
Underground labor	0.340	0.242	0.337	0.261	0.308	0.360	0.392	0.342
Explosives	0.049	0.120	0.137	0.173	0.057	0.195	0.111	0.141
Timber	0.067	.....	.....	.....	0.091	.....	0.008	.....
Hard iron and supplies	0.098	0.089	0.162	0.130	0.112	0.091	0.197	0.118
Power	0.085	0.124	0.083	0.094	0.129	0.100	0.027	0.081
Oil	0.012	0.015	0.014	0.011	0.009	0.014	0.014	0.015
Fire insurance	0.005	0.005	0.004	0.004	0.005	.....	0.016	0.006
Liability insurance	0.015	0.014	0.016	0.016	0.015	0.020	0.023	0.020
Interest and depreciation	0.026	0.019	0.019	0.012	0.011	0.050	0.015	0.013
Total	0.875	0.784	0.958	0.840	0.886	1.023	1.003	0.908
Amortization	0.159	0.112	0.101	0.056	0.102	0.110	0.125	0.104
Grand total	$1.034	$0.896	$1.059	$0.896	$0.988	$1.133	$1.128	$1.012

one. A premium is paid for concentrates containing galena or lime.

A table of costs is given above.

Miami Copper Co.

The cost of developing and equipping the Miami Copper Co.'s property has been approximately $4,157,000, not including some expenditures charged to operations since active production began. The amounts shown in the report for the year ended Dec. 31, 1912, are given herewith: Preliminary development, $241,998; mine development, $928,615; shaft No. 4 development, $107,056; total development, $1,357,429. Mine development charged off to operations in 1911 and 1912 amounted to $462,460, making a total of $1,819,889 for development to date. However, as the mine was ready for production in 1910, the amount standing on the books ($1,357,429) should represent about the expenditure required to prove sufficient ore reserves for planning operations and getting the mine in shape for production. The last of the six sections of the mill was completed in February, 1912. The capacity of the mill is approximately 3000 tons per day, or about 1,080,000 tons a year, allowing 360 days. The concentrator, not including power plant, stands on the books at $1,579,189, and in addition to this $84,716 for betterments and replacements were charged in 1912 to operations. Considering that it is a new mill, this amount should be included in the initial cost. The water-supply equipment cost $280,339, making a total of $1,944,244 for the concentrating plant. Underground equipment cost $164,797; shaft No. 4 equipment, $125,565; and miscellaneous equipment, $5452; total, $290,362 for equipment. Mine buildings, dwelling houses and sundry construction cost $226,758 and power plant, $629,433. From these figures it is apparent that it has cost about $4,157,854, or $3.84 per ton of present annual capacity to develop and equip the property, made up as follows: Development, $1.25; mill, $1.80; buildings, 21c.; and power plant, 58c. per ton of annual capacity.

Milling Costs at Hollinger

The Hollinger mill, at Porcupine, Ont., was started in June, 1912, and for the first two weeks nothing was treated but waste rock and low-grade ore with the idea of meeting and remedying all mechanical defects incident to a new mill and putting everything in first-class order before valuable ore was handled. Cyaniding was started early in July, and until Dec. 31, the amounts of ore milled for each four-week period are as follows: June 15 to July 13, 4447 tons; July 14 to Aug. 10, 6132 tons; Aug. 11 to Sept. 7, 7606 tons; Sept. 8 to Oct. 5, 7905 tons; Oct. 6 to Nov. 2, 8012 tons; Nov. 3 to Nov. 30, 6335 tons; Dec. 1 to Dec. 31, 4758 tons. The total tonnage amounts to 45,195, with a total amount of $933,682 recovered.

The mill operated in a satisfactory manner and the process adopted is believed to be the correct one for the treatment of Hollinger ores. Originally, the practice was to amalgamate concentrate in pans, in order to remove the contained gold, but after several months of experimenting, amalgamation was abandoned in favor of cyanidation of the concentrates.

The agitators, which were adopted originally, did not prove to be satisfactory for handling the heavy Hollinger slime, and the Trent apparatus has been discarded in favor of Dorr agitators, which have proven satisfactory. By the use of the Dorr mechanism, continuous decantation is practicable and is expected to result in an increased saving of the dissolved gold, and may enable a considerable saving in treatment charges by the possible avoiding of the expensive filtering process.

The year's work was badly deranged by labor troubles, so that statistical data is inconclusive. The accompanying table shows the milling costs for the four weeks ended Feb. 25, 1913, the tonnage treated being 9257 tons.

OPERATING COST AT THE HOLLINGER MILL

Account	Per ton of ore milled
General charges	$0.160
Superintendence	0.075
Heating	0.076
Lighting	0.020
Watchman	0.009
Sampling	0.006
Assaying	0.033
Coarse crushing	0.073
Conveying	0.034
Stamping	0.181
Classification and tube milling	0.277
Concentration	0.057
Handling concentrate	0.012
Grinding concentrate	0.036
Handling pulp	0.022
Thickening	0.012
Agitation	0.029
Filtration	0.147
Acid washing	0.013
Neutralizing	0.023
Clarification and precipitation	0.074
Smelting and retorting	0.063
Pumping solutions	0.020
Cyanide	0.041
Total	$1.493
Extraordinary expenses, including plant alterations	0.200
Total	$1.693

Classification and tube milling in this table includes the cost of repairing the linings of three tube mills.

Notes on Diamond Drilling

A record of diamond drilling, in a flat limestone area, covering about 95,000 ft. of holes ranging from 200 to 500 ft. in depth, 1-in. cores, and wages averaging about $2.50 per day for the full crew, shows a total cost per foot ranging from 38 to 96c. and an average of about 66c. per ft. Depreciation is not included, but all repair parts were charged in with supplies. From 24 to 25 ft. were drilled per 10-hr. shift; in some instances the drilling rate was as high as 32 ft. per shift. Approximately one ton of coal was consumed for every 46 ft. of holes drilled. Of the total cost about 45% was for labor, 26% for carbon wear and 20% for supplies and transporting. Coal made up about 47% of the supply cost and transporting supplies and outfit about 26%, the remaining 27% of the supplies consisted of various repair parts, tools, etc., for drilling.

Tonopah Mining Co.

According to the annual report of the Tonopah Mining Co., Tonopah, Nev., for year ended Feb. 28, 1913, 173,336 dry tons of ore were milled at a cost of $9.04 per ton, made up as follows: Mining, $3.27; milling, $2.67; freight on ore to mill, 74c.; marketing mill product, 51c.; and metal losses in milling and refining, $1.85 per ton. The average gross value of the ore milled was $18.16 per ton and profits $9.12 per ton, or practically 50% of the gross value of the ore. The mining cost of wet ore and waste hoisted was $2.73 per ton.

Life Factor in Mine Valuation

By A. Cooper Key*

SYNOPSIS—Regularity of deposits on the Rand make possible the determination of the life of the mines with great accuracy. Because of the influence of compound interest a long life does not add to the present value of a mine to the extent commonly supposed.

On the Rand, much attention is paid to the matter of mine lives, which, owing to the regularity of the deposits, are capable of being determined with a measure of accuracy which would astonish those who deal with mining ventures in other parts of the world. Certain of the leading groups submit estimates of the probable duration of their mines. Recent examples are the Witwatersrand Deep, estimated to have a life of 12.9 years from May, 1912; the Wolhuter, 10.7 years from October, 1911; and the New Kleinfontein, 13 years from the end of 1912. These instances happen to be indicative of short lives, but certain of the later consolidations are estimated to have lives of from 40 to 50 years. It need scarcely be pointed out that lives will be extended on an attenuated basis of profits resulting from the treatment of lower-grade ore left in the workings when operating costs were much higher than today, and from the treatment of the main reef itself, which is usually poor. The Village Main Reef, for example, was estimated to have a life of five years from June, 1912, irrespective of low-grade ore, but the profits will be different from the £47,500 or £50,000 per month, ruling last year. The Robinson also is now using an increasing proportion of low-grade ore.

Mines Department Estimates Lives

Under the mining taxation act, the gold companies are allowed to amortize the capital amounts expended upon development and equipment. It thus becomes necessary for the Mines Department to calculate the lives of the companies in order to determine the period factor. These calculations are on the conservative side, that is, they place the life at a shorter number of years than will probably represent the duration of the property. Such calculations are revised periodically, usually every five years. The calculations which have been put forward by the companies and their engineers, have also proved as a rule to be framed on conservative lines. In the financial year ended Mar. 31, 1911, the number of mines which made a taxable profit was 62, their aggregate profits amounting to £11,385,696. Out of this, £1,669,946 was allowed for amortization, leaving taxable net profits of £9,715,750. The government received £937,143, representing 8.23% of the aggregate profits made. The allowance for amortization was thus 14.7% of the profits.

Rate of Interest Required Influences Prices

In times of depression one sometimes sees shares at values which do not reflect even the amount spent upon development and equipment, to say nothing of the value of the ground. The difference between boom and slump values for mining shares is largely a matter of the rate of interest assumed for valuation purposes. On the Rand the extremes are probably 6 and 10%, though individual mining conditions must be exceptionally good and money cheap to admit of the minimum rate. Doubtless, 7 and 10% represent more general limits. With many sound investments offering 4½ or 5% with an almost infinitesimal risk of severe capital depreciation, a really serious contingency in mining shares, speculative investors in mines naturally ask for a higher rate than would have satisfied them a few years back, when monetary conditions in the exchanges of the world were different.

The unpleasant experiences in connection with certain of the Rand's leading mines, for instance, the East Rand Proprietary, the Witwatersrand Deep and the New Kleinfontein, in which capital depreciation has been serious, constitute another factor tending to advance the rate of return demanded by people who put their money in mines.

It is not unusual to value Rand shares on the basis of a clean 10% discount factor. How does the difference between 7% and 10% affect the price of a share? The discounted value of a mining share paying 10s. a year over 18 years, is £5 in the 7% table, but in the 10%, only just over £4. This difference in the valuation basis assumed, may lead to a variation of 25% in the value of a share.

With long-lived mines, the amortization factor ceases to be of high importance, for the operation of compound interest is such that the amount required to be set aside each year to replace capital, decreases sharply after 20 years. On the 4½% accumulative tables, 7½d. a year is required to accumulate a sovereign at the end of 20 years, but if the period be 30 years, the amount falls to 4d. With durations of over 15 years, amortization is about one shilling on the £1 per annum and it is fairly safe to relegate it to a secondary position, as it is impossible accurately to gage other factors of a favorable or adverse tendency.

Long Lives Add Little to Present Values

Sometimes people strive to justify the high price of a mining share by the long life expected for the property, but from a mathematical standpoint, a short life and a merry one is best. With discount at 8%, a mining share has to have a life of 23 years to possess a present value double that of a share in a mine with seven years assured duration. Shares of a mine paying 3s. a year, with a life of 13 years, are on a 10% basis at 21s. 4d.; increase the life two years, and the present value is but 1s. 6d. higher; increase it to 20 years and the quotation justified is no better than 25s. 6d. In other words, if the life be increased 50%, the value is enhanced only 20%.

As the term of years increases, the increase in present value becomes remarkably slower. Whether 35 years or 25 years, makes but little difference on the 10% table, and an extension from 30 to 50 years justifies an advance in share quotation of only half a year's purchase. If, instead of considering a clean 10% discount factor, the valuation be based on a 6% remunerative and a 3% accumulative, the difference in value is greater; but even so, a mine has to last 40 years to make its shares worth

*Editor, "South African Mining Review," Box 3621, Johannesburg, So. Africa.

double that of a property with a decade's duration, assuming the same dividend throughout the period. After 20 years, 10 years' dividends of 5s. are worth only 8s. today, while after 40 years, they have a present value of only 4s. One must, therefore, be careful to guard against the fallacy of the long life.

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Johannesburg Notes

On the Far East Rand, the main reef has been struck at 3420 ft. in the shaft of the Springs mines. Where intersected, the reef is 34.5 in. wide, but of somewhat low value, 5.95 dwt. There is, however, a large proportion of unpayable ground all over this area, and it is a mere matter of chance as to what grade is first encountered. The two shafts on the north side of the State mines (Modderfontein areas) are both bottomed on poor reef, while development has since disclosed a fair proportion of ground of high value.

The Brakpan mines are increasing their mill from 160 to 200 heads to crush 900,000 instead of 700,000 tons per year. In this mine, about 40% of the reef is unpayable; naturally, however, development is not pushed in the poorer areas. Development continues to give good results in the Van Ryn Deep mine and the mill of 80 stamps and eight tube mills, is expected to start work in June and to crush 40,000 tons per month. Rich ore is being exposed in the workings. Development work on the East Rand basin is, however, generally much behind what it should be if the place of the older outcrop mines approaching exhaustion is to be taken by new producers.

No offers were received for the new State mines lease of the area lying south of the Modderfontein Areas State mine. The Rand Collieries Gold Mining Co. is almost idle, the Van Dyke mine is closed down, shaft sinking is suspended on the Welgedacht and Grootvlei mines, and is almost stopped on Daggerfontein. There are large areas around these properties lying idle, which will take four or five years to bring to a producing stage. Unless the share market can be stimulated, the "houses" have at present no chance of raising fresh capital, and while European troubles continue, the prospect of a boom seems slight. A number of shares are now down to or below their true value and afford a fair return as investments, while a number of developing mines offer good chances as speculations.

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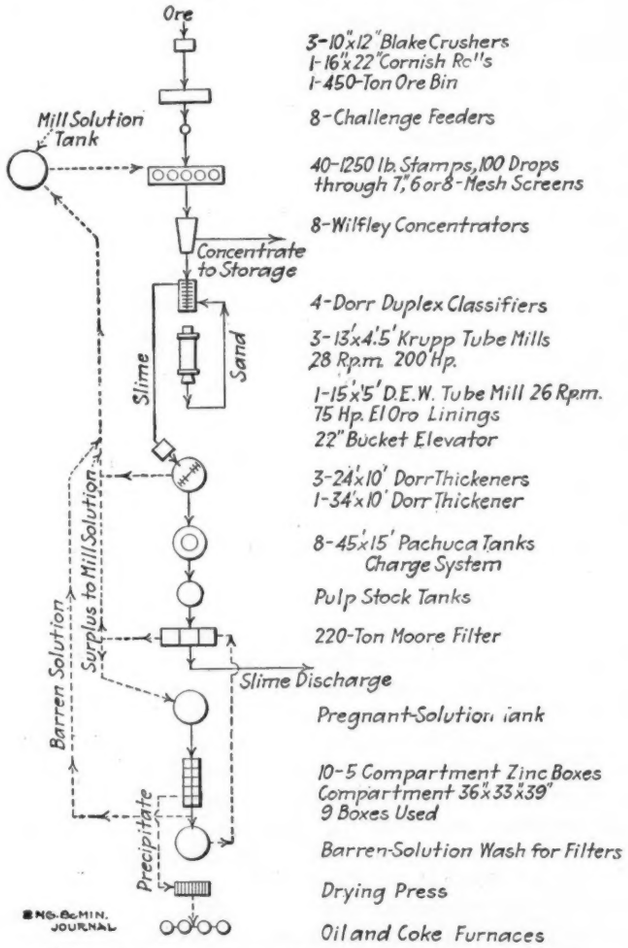
For Disposal of Indian Lands Containing Kaolin

A bill (H. R. 3398) has been introduced by Representative Martin, of South Dakota, to provide for the purchase and disposal of certain lands containing kaolin, kaolinite, fuller's earth, and other minerals within portions of Indian reservations heretofore opened to settlement and entry.

Be it enacted, that all lands containing kaolin, kaolinite, fuller's earth and other minerals within such parts of Indian reservations as have heretofore been opened to settlement and entry under acts of Congress which did not authorize the disposal of such mineral lands shall be open to exploration and purchase and be disposed of under the general provisions of the mining laws of the United States, and the proceeds arising therefrom shall be deposited in the Treasury of the United States for the same purpose for which the proceeds arising from the disposal of other lands within the reservations in which such mineral bearing lands are situated were deposited.

The San Francisco Mill, Pachuca, Mex.

A description of the first cyanide mill erected in Pachuca, Mex., is given in *Bulletin* No. 103, of the I. M. M., Apr. 10, 1913, by J. P. Holcombe. The plant is interesting on account of containing the pioneer installation of Brown or Pachuca tanks in America. It was originally built as a custom mill using pan amalgamation, but was taken over by the Maravillas company, since which time the mill has been treating the ore from the Maravillas mine. The plant is electrically driven, as is practically all the machinery in the Pachuca district.



FLOW SHEET OF SAN FRANCISCO MILL, PACHUCA

The mill contains three 10x12-in. Blake crushers; one set of 6x22-in. rolls; forty 1250-lb. stamps; eight Wilfley concentrators; four Dorr classifiers; three 13x4.5-ft. Krupp and one 15x5-ft. Denver Engineering Works tube mills; four 10x54-in. Frenier pumps; four Dorr thickeners, three 24x10-ft., and one 30x10-ft.; eight Pachuca tanks, 45x15 ft.; two bucket elevators, 22 in. wide, buckets 18 in. apart, and one Moore vacuum filter, with the necessary pumps, tanks, compressors.

The ore, coming from several mines and dumps, contains silver principally in the form of sulphides, with some manganese, galena and blende and also pyrites. The heavy minerals are taken out by concentration. The mill head averaged 19.12 oz. Ag and 0.091 oz. Au per metric ton. Ore is received in the yard and trammed to the

rockbreakers and rolls placed over the ore bin, which holds 450 metric tons. Ore is broken to pass a 2½-in. ring, the rolls acting as a fourth primary crusher.

Crushing by Stamps in Cyanide Solution

Crushing is in cyanide solution, and after leaving the stamps, the pulp is concentrated on Wilfley tables, about 14% of the contained valuable mineral being recovered. The concentrate is conveyed through pipes directly to sumps in the concentrate storage room.

Stamps are said to have much greater capacity than the tube-mill installation, explaining the low stamp duty of 5.57 metric tons per day. Thickness of tube-mill feed is striven for, and is maintained at about 35% moisture, and the Denver mill is said to perform better than the others. El Oro linings are used and mine rock only is used for pebbles. Large pieces are fed through a 6½-in. spiral feeder while running. The consumption of rock is 67.5 lb. per ton of ore.

From tube mills, the pulp is taken to the Dorr classifiers, the overflow from which consists of slime only, 80% through a 200-mesh screen. The classifier overflow has a dilution of 8:1 and is thickened in the thickeners to 1.2:1 and flows by gravity to the Pachuca tanks, where sodium cyanide is added to bring up the

MILLING COST AT SAN FRANCISCO, PACHUCA

	Pesos per ton milled
Rockbreakers	0.11
Batteries	0.24
Concentration	0.04
Tube mills and classifiers	0.29
Agitation	1.05
Filtration	0.16
Pumping	0.09
Precipitation and melting	0.41
Sampling and assaying	0.13
Outside expense	0.05
General repairs	0.17
Power	0.81
General expense	0.31
	3.86

strength to 0.4% KCN. Protective alkalinity is kept at 2 lb. CaO per ton of solution by adding lime at the tube-mill feed. Lime consumption is 9.7 lb. per ton of ore crushed.

Charge System of Agitation

The charge system of agitation is followed, each tank filled separately, and when filled, titrated and sampled, agitation maintained for 36 hours, followed by a rest of 10 or 12 hours. Afterward as much agitation as time will permit is given before filtering. No lead acetate is added to the Pachuca tanks, but an amount equal to 0.66 lb. per ton of ore crushed is added to the mill solution at regular intervals. The cyanide consumption is 1.83 lb. per ton milled.

The filter plant is a Moore with a 40-leaf basket continually working, and there is a spare basket of the same size in addition to a number of spare leaves. The leaves are given an acid bath every month. Filtering capacity is 220 tons per day, and the plant has been working satisfactorily for 13 months. The cycle occupies 86 min., divided as follows: Making 1¼-in. cake, 20 min.; transfer, 3 min.; barren solution wash, 40 min.; transfer, 3 min.; water wash, 15 min., and discharging, 5 minutes.

Strong solution from the filter, and first 10 min. of solution wash, is sent to pregnant-sclution tanks, the rest of the solution wash being precipitated apart and returned to filter for cake washing.

Precipitate Not Acid Treated

Cleanup of precipitate is made every week from the zinc boxes. The zinc consumption per kilogram of bullion produced is 1.101 kg. Precipitation is entirely satisfactory. The precipitate is washed through a 40-mesh screen and pumped through a filter press without acid treatment. It contains 80 to 85% bullion. The precipitate is melted in stationary oil-fired furnaces, the consumption of fuel being 0.328 gal. per kg. of bullion. The bullion fineness is 940 in silver and 4 to 5 in gold. The average cost per metric ton during the period, January to June, 1912, was as shown in the accompanying table. The extraction was 92.4% of silver and 94.5% of gold during the period. The flow sheet shown herewith explains the installation and movement of pulp.

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Increasing Safety in Coal-Mining Operations

Coal-mine accidents occurring in the United States during 1912 have been less than in former years, according to Frederick W. Horton, of the U. S. Bureau of Mines. Mr. Horton, in reviewing the year, says:

In 1912 the number of men killed in the coal mines of the United States was 359 less than in 1911, or 2360 as compared with 2719, a decrease of 13.2%, and this in spite of the fact that there were more men employed in the mines and more coal mined than in any previous year.

The death rate per 1000 men employed in 1912 was 3.15, as against 3.73 in the previous year, a decrease of 15.5%. During 1912 for every 1,000,000 tons of coal mined 4.29 men were killed as compared with 5.48 men in 1911, a decrease of 21.7%. There was 233,000 tons of coal mined for each man killed in 1912, as compared with 183,000 tons in 1911, an increase of 50,000 tons, or 27.3 per cent.

NUMBER OF MEN KILLED IN AND ABOUT THE COAL MINES OF THE UNITED STATES IN THE CALENDAR YEARS 1907 TO 1912, INCLUSIVE, WITH DEATH RATES

	Number killed			
Year	Total	Per 1,000 employed	Per 1,000,000 short tons mined	Production per death, short tons
1907	3,197	4.88	6.93	144,000
1908	2,449	3.64	6.05	165,000
1909	2,668	4.00	5.79	173,000
1910	2,840	3.92	5.66	177,000
1911	2,719	3.73	5.48	183,000
1912	2,360	3.15	4.29	233,000

Although there has been an annual improvement in mine-safety conditions since 1907, and a particularly notable one in 1912, a still greater decrease in the death rate can be effected. Whether or not such an improvement will be made in 1913 depends largely on the care exercised by the operators, superintendents, foremen and all others in authority, and by the miners as well, to prevent the rise of dangerous conditions and to avoid unnecessary risks when such conditions have arisen.

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The U. S. Steel Corporation as a Consumer of Tin

The following interesting information is taken from the examination of President James A. Farrell, of the U. S. Steel Corporation, at the hearing this week in the Government suit against the Steel Corporation.

Q. Under what arrangements do you get your pig tin?

A. We have our own men located at Singapore and Penang. They buy every day from the smelters and Chinese who are engaged in the industry. We are the largest consumers of pig tin in the world.

Q. There was a reference made in the testimony of one witness for the government, Mr. Trench, to some sales of tin

made by you representing the corporation, or the Steel Products Co., to other manufacturers at times. What are the facts, in reference to these sales?

A. The speculators in London are either trying to corner tin for a rise, or trying to "bear" tin, and very often the supplies of tin are contracted, and as a result there are violent fluctuations in price. We always have large supplies of pig tin, and we have been asked—I will not say importuned—but we have been asked time and again by competitors of ours to let them have tin, and we have sold them tin. As a matter of fact every time a corner is attempted we always give people all the tin they wish at a cost of ½c. per lb. over and above our import cost of tin. We do not make any profit on it, ½c. per lb. just covering the cost of foreign exchange.

Q. Are those the transactions Mr. Trench referred to? Have you dealt with him in those matters?

A. Yes.

Q. Are there any other sources of pig tin that are available to American manufacturers, except the Straits?

A. Yes, Australia, Tasmania and the Island of Banca and Billiton, off the coast of Java; but the Java tin and what is known as the Banca tin are not available for use in making tin plate, because of moisture which causes explosions in the pot. Bolivia also produces 15,000 tons of tin per annum, which is not suitable for tinplate because of the arsenic in the tin.

Radium from American Carnotite

PHILADELPHIA CORRESPONDENCE

The American supply of carnotite, in previously published accounts, appears to have been underestimated. Doubtless this has been due to the fact that only a comparatively small fraction of the obtainable ore has been put on the market, for it appears from late information that buyers abroad have been unable to secure a regular supply of ore of acceptable grade. The ore beds of greatest extent are controlled by wealthy companies or syndicates, which are not selling their ores but are holding them available for the extraction of radium, vanadium and uranium in this country.

The puzzling character of the work has necessitated the expenditure of large sums in an effort to surmount the difficulties which are to be overcome in order to succeed in extraction upon a commercial scale—in order to be profitable—even at the high price of radium. An important announcement in this direction is the formation of the Radium Co. of America, with a capital stock of $1,000,000. This company has taken over a Philadelphia syndicate, which has been engaged in acquiring and mining ore from the discovery of radium, all ore supplies on hand, properties, process of manufacturing, etc., and is now equipping a large and well adapted factory and laboratories in Bucks County, Penn. This company has exhibited its products to experts, who have pronounced them of the highest degree of purity.

The operations of the Radium Co. of America will be looked forward to with interest, not only in this country, but abroad, because of the control it will have of a large supply of radium from its initial plant. Dr. Siegfried Kohn, an Austrian chemist, is in charge of the technical department and is now visiting European centers on this company's business.

Another company in Pittsburgh is said to have similar facilities (ENG. AND MIN. JOURN., May 17, p. 989), and it is safe to say that in the near future the world's stock of radium will be largely increased from this country. There are indications that the uses and consequent demand for this wonderful element are increasing in much greater ratio than all the anticipated production here and abroad, so that there is ample room for both companies.

The Uranium and Radium Situation

Some months ago the U. S. Bureau of Mines began investigating the increased demand for carnotite ores from Colorado, their export, the report that the methods of production involved large losses of material, and that methods for concentrating low-grade material now being thrown on the dump were needed, says Charles L. Parsons.

The conclusion was reached that while all the radium marketed has been produced in Europe, a large portion of this output has come from American ores.

Even before carnotite was exported, at least 20 to 25 tons of high-grade pitchblende were sent out of the country. Within the last two years, however, foreigners have realized the value of our carnotite resources and most of the radium that has been exported has gone abroad in this ore.

During 1912 carnotite carrying 28.8 tons of U_3O_8, from which 8.8 grams of radium chloride or 11.43 grams of radium bromide could be obtained, were produced.

Pitchblende, the richest of all uranium minerals, is composed mainly of uranium oxide but also carries lesser quantities of a large number of other substances. It has been found in small quantities in Connecticut and in the feldspar quarries of North Carolina. Practically the total American output has come from the mines in Quartz Hill, Gilpin County, Colo. The mineral is a heavy black substance which can be readily identified by any one who will suspend a sample of the pitchblende above a photographic plate wrapped in black paper and kept in the dark for a few days with a key or other metal object, opaque to radium radiations placed between the sample of ore and the plate so that when the plate is developed a shadowgraph of the object may identify the ore. Pitchblende may carry as high as 80% uranium oxide, although the average ore is not nearly as rich.

Carnotite is a yellow mineral consisting mainly of potassium-uranyl vanadate, but containing also small amounts of barium and calcium compounds. The more important deposits are scattered over a considerable area in Colorado and Utah, embracing Meeker and Skull Creek, Colo., Green River, Thompson's, Moab, Richardson, Table Mountain, Pahreah, and other places in Utah. The largest proportion of the ore, however, has been produced in or around Paradox Valley in southwest Colorado, from which it has to stand long hauls by pack animal or wagon to the railroad. Carnotite always carries vanadium as well as uranium and radium, but is purchased almost wholly on its radium content, comparatively little being allowed for the vanadium present.

The ore consisting of a fine-grained sandstone containing yellow finely pulverized carnotite occurs in pockets and is easily mined. As ore below 2% uranium oxide cannot at the present time find a market, a considerable portion of the ore has been thrown on the dump and is now being wasted, as material of lower grade has to be discarded on account of the long haul and the fact that European buyers have set this standard as to quality. Ores of higher grade are sometimes obtained, but they occur only in small pockets and it is generally advisable to mix these high-grade ores with ores of somewhat lower grade in order to increase the marketable output. Ore of 2% uranium oxide is now worth approximately $75 per ton, f.o.b. New York.

The Future of Alaskan Gold Mining

WASHINGTON CORRESPONDENCE

Falcom Joslin, testifying before the Senate Committee on the territory of Alaska a few days ago, gave expression to opinions now prevailing with respect to placer mining in that territory, in which he said:

In my judgment the placer-mining industry in Alaska will last a thousand years, the area suitable for placer mining is so enormous. What we are working there now is only the gravels that will carry from $3 to $10 per yard. You cannot work gravels that carry less than that, but once we have transportation there, and can work gravels such as they do in California, which carry 7c. per yard, we have got so nearly an unlimited area of it that no man can foresee the end of that industry in Alaska. There are 20 or 30 dredges in the Seward Peninsula. There is one dredge at Fairbanks and another in the Circle City district. There are eight or ten dredges in the Klondike, which is identically similar country. They operate about 150 days per year. They usually work up until November, beginning some time in May. They are working gravels at Dawson, which is an older camp than Fairbanks, that carry 50c. per yd. And in some cases they are working gravel by dredging as low as 40c. per yd. at a profit in the Dawson country. We will eventually, when our transportation gets better, be able to work gravels of that tenor in Alaska.

One great thing is that nearly the whole area of Alaska is gold bearing. There are placers and quartz. It has been said, and I believe the statistics and explorations of the Geological Survey show it, that you could go from the extreme southeast of Alaska, at Ketchikan, where there are important mines, along this route by way of Hains, clear out to Nome, a distance of 2000 miles in a straight line, and that in every 20-mile section along that route you could develop gold mines. It is infinitely greater than any other area of gold country that has ever been found in the world. In the state of California the gold production in the past 60 years has been about $1,500,000,000. The reports of the United States Geological Survey estimate that this little peninsula, Seward Peninsula, on which the town of Nome stands, contains approximately as large an area of placer gravels as there is in California. It is by no means superior to the area of the Tanana placer gravels, and probably not superior to those in the Iditarod, nor in the Koyukuk, nor in the Forty-mile.

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April Oil Dividends

April dividends paid by the oil companies of California aggregated $1,352,122.62, says the Los Angeles *Tribune*, May 11, 1913. This was the largest cut of the melon for several months excepting the month of March, when the amount included $1,125,000 Standard Oil of California, $600,000 of the Associated and $105,000 of the Producers' Transportation. The dividends paid in April by companies follow:

	Par value	Rate per share	Amount
Amalgamated	$100.00	$1.00	$50,000.00
Associated	100.00	1.50	600,000.00
American Pet. pfd.	100.00	0.50	8,255.50
do common	100.00	0.33⅓	39,607.00
Central	1.00	0.02	20,000.00
Claremont	1.00	0.01	4,500.00
Columbia	1.00	0.01¼	51,283.36
Dome-Pinal	1.00	0.01	4,000.00
Fullerton	1.00	0.05	30,000.00
Home (Coalinga)	1.00	0.01	1,000.00
Mt. Diablo	1.00	0.00½	7,500.00
Olinda Land	1.00	0.00¼	15,000.00
Paraffine	1.00	0.01	3,000.00
Pacific Crude	1.00	0.01	6,969.04
Prod. Trans.	100.00	1.50	105,000.00
Record	2.00	0.05	10,000.00
Rice Ranch	1.00	0.01	3,000.00
S. F. and McKit	10.00	0.10	5,000.00
do extra	10.00	0.10	5,000.00
Sauer Dough	0.50	0.015	2,992.50
Section 25	1.00	0.50	20,000.00
State Consolidated	1.00	0.01	5,000.00
Union Oil	100.00	0.60	184,753.60
Union Provident	100.00	0.60	91,403.02
United Petroleum	100.00	0.60	48,450.60
West Coast	100.00	1.00	10,408.00
Western Union	100.00	0.50	5,000.00
W. K.	1.00	0.02	10,000.00
Total			$1,352,122.62

The Mason Valley Smeltery

The smeltery of the Mason Valley Mines Co. is situated on the property of the company, which consists of 1320 acres of land, containing not only the smeltery, but the town of Thompson, Nev., and the source of water-supply. In addition to the smeltery site, the company owns the Gregory ranch, comprising 320 acres of irrigated land. The details of the smeltery and its operation are contained in the report of the Mason Valley Mines Co. for the year ended Dec. 31, 1912.

Water supply for the smelting operations and domestic service is obtained from artesian wells. The wells were developed by churn drilling, water having been encountered at a depth of 300 ft. The larger well is at a depth of 600 ft. and flows 120 gal. per minute.

The smeltery was blown in on Jan. 6, 1912, and one furnace has been in continuous operation since that time. The plant consists of two blast furnaces, which, it was estimated, would treat a minimum of 400 tons each of ore per day. These furnaces have exceeded this estimated capacity by approximately 100%, and, with the completion of enlargements now in progress, the plant will have a capacity of 1800 tons of ore per day. All machinery and equipment have been found to be efficient, and no changes in the method of operation, as originally designed, have been necessary.

Owing to the increased capacity of one furnace, and the large tonnage of custom ore received, it has been necessary to make certain alterations in the furnaces and add other equipment, as mentioned hereafter. The smeltery product is a copper matte, containing approximately 40% copper, which has been shipped to the Garfield Smelting Co., near Salt Lake City, for converting, and the resulting copper, in the form of refined electrolytic copper, is delivered to the American Smelting & Refining Co.'s refinery.

A capacity of 100 tons per hour is obtained in the ore-sampling department. All ore is first crushed to 4-in. size by a No. 8 gyratory crusher. From this crusher it is elevated and sampled by a series of Vezin samplers. The cutout from the sampler is taken by a belt conveyor to the charge bins or storage bins. Five new storage bins with a total capacity of 3000 tons have been added during the year. Conveyor belts carry the mixture from the bins back to the sampling mill elevators, thus enabling an accurate sampling of the mixture and a rapid mechanical means of handling the ore to the charge bins. The hopper-scale method of weighing charges has proven a rapid and accurate method of performing this work.

Two blast furnaces installed were 25 ft. in length by 44 in. in width at the tuyeres. As mentioned above, these furnaces have been smelting twice the tonnage originally estimated, under which conditions one furnace could not handle the entire tonnage of custom ore, together with the minimum tonnage considered advisable to ship from the Mason Valley mine. It was, therefore, decided to increase the length of No. 2 furnace from 25 to 30 ft. This work was completed and the larger furnace started on Sept. 19, and is now handling an average of 985 tons of charge, exclusive of coke. It has since been decided to enlarge No. 1 furnace from 25 to 35 ft. When this work is completed, the combined smelting capacity will be approximately 1800 tons of ore per day.

There has been no change in the blower or transformer equipment, there being two Connersville blowers of 30,000 cu.ft. capacity per min. These blowers are driven by four 200-hp. induction motors. A 100-kw. motor generator is set in the blower room and is used to supply direct current to the electric locomotive in the plant. There are three 500-kw. oil-insulated, water-cooled transformers, complete with oil switches, line arresters, and the necessary fixtures.

The Dwight & Lloyd sintering process has been used in handling flue dust, fine ore and concentrate. One machine was first built and operated, and later it was found advisable to install a second unit to handle the increased tonnage of fine ore and flue dust. The two Dwight & Lloyd machines have a capacity of 200 tons of product per day.

Locomotive equipment for charge trains consists of two Jeffrey 4-ton electric locomotives and 24, 2-ton, rocker-dump charge cars. A third electric locomotive is used in operating the cars holding the matte molds. The slag-hauling equipment has worked satisfactori'y and the large 20 ton capacity slag pots are especially adapted for the conditions. The slag pots are hauled by a 15-ton Jeffrey locomotive.

Improvement of the water system has been accomplished by laying an additional 4-in. pipe line from the flowing wells to the smeltery reservoir. A reservoir has also been built near the wells from which the water is pumped to the smeltery. A larger and more efficient cooling tower, found necessary on account of the increased amount of water from the blast furnaces, was constructed, and auxiliary pumps were installed to provide continuous pumping facilities for the blast furnaces.

Custom-ore receipts at the smeltery have been an important factor in the operation. During the year there have been received 146,530 tons of custom ore. These shipments have been made by more than 130 different shippers, and from 30 different mining districts in Nevada and California. The present activity in the mining camps tributary to the smeltery assures an even greater tonnage and indicates the probable development of important mines during the coming year.

Practically all of the difficulties incidental to the starting of a new mine and reduction plant have been overcome, but efforts will be continued during the year to improve metallurgical results and to effect all possible economies. The installation of converters, which has now been decided upon, will materially assist in saving and enable the purchase and treatment of more refractory ores at a profit.

Analysis of Zinc Dust

An error occurs on p. 793 of the JOURNAL for Apr. 19, 1913. The reaction (*b*) should read:

$$K_2Cr_2O_7 + 6\,KI + 7\,H_2SO_4 = 3\,I_2 + 4\,K_2SO_4 + Cr_2(SO_4)_3 + 7\,H_2O$$

A line of type has been displaced and a foreign one inserted in printing the article.

The table called 11 should be Table 10, as should the reference below it. It was found necessary to omit two tables, which were numbered over 10 and therefore the reference numbers to these tables on p. 797, first paragraph of second column, should have been omitted also.

East Rand Proprietary Mines

JOHANNESBURG CORRESPONDENCE

The annual report of the East Rand Proprietary Mines, of unsavory reputation, shows that the administration has been placed on a better footing. The net working profits for 1911-1912 were £909,108, and of this sum, £611,474 were paid in dividends, being 25% instead of the promised 40%. The total recovery was 32s. 1d. per ton, compared with 25s. 4d. in 1911. The increase of grade was due partly to selective mining and partly to reduced stoping widths, 53 in. for 1912, against 67 in. in 1911. Closer sorting was done and much unpayable development rock was sent to the dumps instead of being crushed. The tonnage disclosed by 57,440 ft. of development work was 1,774,631 tons, of which 1,029,106 were payable, averaging 8.2 dwt. over a milling width. Ore reserves were, however, encroached upon, owing to the presence of water in depth, not allowing development to be pushed in the richer areas.

The payable reserves amount to 6,013,330 tons of a value of 6.8 dwt. over 54 in. There are 8,166,327 tons of a value under 4.3 dwt., which may be worked later when costs are reduced from the present level of 20s. 10d. per ton milled. The disquieting feature about this large undertaking is that in the upper levels practically all the ore was payable, while this unpayable tonnage has been accumulated within the last four or five years, and the deepest areas, about 4000 ft. deep in the Hercules and Angelo Deep sections, show still further reduction of the payable percentage and render the life and future of the property precarious. It was the concealment of these facts that enabled the management to boom the shares above their value. The same administration was also responsible for certain proceedings in the case of the New Kleinfontein mine which show in a still worse light. The facts, however, in this case, are not generally known to the public.

Utah Copper Co.

The report of the Utah Copper Co. for the first quarter of 1913, shows a gross production of 23,884,467 lb. of copper, the monthly average being 7,961,489 lb. Total ore treated was 1,460,707 tons, at both Garfield mills, of which the Magna plant treated 53% and the Arthur plant 47%. Average grade of the ore was 1.2495% copper. After making allowances for smeltery deductions and without crediting miscellaneous income, the cost per pound of copper produced was 10.175c. By crediting miscellaneous income, including earnings of the Bingham & Garfield Ry., the net cost of copper would be reduced to 9.521c. per pound.

Net profits from milling operations for the quarter were $1,110,347; other income, $49,828; income from Nevada Consolidated Copper Co. dividends, $375,187 making total net profit of $1,535,362 for the quarter. Dividends of $1,186,627 were paid, leaving $348,735 surplus for the quarter. The price of copper for the quarter was 15.069c. per pound.

Stripping was delayed by weather conditions, there having been 822,246 cu.yd. of capping removed during the quarter. The Bingham & Garfield Ry. did a good freight and passenger business, carrying an average of 10,602 tons of ore and 623 tons of miscellaneous freight per day.

CORRESPONDENCE AND DISCUSSION

The Cornish Miner

The notes about the Cornish miner by P. B. McDonald, published in the JOURNAL of May 3, recalled to mind the following story: In Cornwall at one time there was a mine manager who was also a local preacher, and one Sunday he had chosen for his text the words of St. Paul: "Who hath believed our report." The preacher repeated the text two or three times, and at last an old, gray-haired Cornishman stood up and said, "It's na use asking 'em, Cap'an, if they knaw'd tha as well as I knaw tha nobody would believe et."

Mr. McDonald states that sometimes the Cornish mine captain and the mining engineer do not get along well together. This is because each arrives at his conclusions by an entirely different course; the engineer reasons things out, the Cornishman just "sees 'em." The following incident will show that this is true in some cases. A few years ago some men in the "Old Country" had considerable money invested in a placer property in the Cariboo district, in British Columbia, and they sent a mining engineer from Scotland to make a report upon the property. It was an old gravel mine that had seen its best days, and the superintendent, who was a Cornishman, was drifting toward a place where he supposed another channel existed. In those days, when supplies were taken in with freight teams, freight rates were high, and makeshifts were used where possible, and in this case the superintendent had used 2x4-in. lumber topped with strap-iron for rails. It was hard work to push a heavy car over these rails, and it often took three or four men to move the car. The mining engineer noticed this, and he was not slow in telling the superintendent that he thought it was a waste of time and money to tram all that waste through such a long tunnel to the outside.

The superintendent looked at him for a moment and then said: "Do you want me to close down the property?" "No, no," said the engineer," "Go ahead and find the other channel." "Then what in h——l am I to do with the dirt if I don't run it outside," shouted the Cornishman. "Do with the dirt, mon, why don't you dig a pit in the bottom of the tunnel and put the dirt in the pit." This was one of the times that the Cornishman had "seen 'em," and the engineer, well—I guess he is still reasoning.

JOSEPH GOLDSWORTHY.

North Vancouver, B. C., May 14, 1913.

Diphenylcarbazide as a Bichromate Indicator

In the JOURNAL of Apr. 26, 1913, is a description of the bichromate-iron determination using diphenylcarbazide as indicator. To make this article of maximum value it seems to me that the manufacture of the carbazide should also be reprinted. This I found by looking up the reference as given in the JOURNAL.

The indicator was prepared by heating 20 grams of urea with 200 c.c. of phenylhydrazine, gradually raising the temperature from 150 to 170° for about four hours. The resulting product was dissolved in hot alcohol, recrystallized by cooling, filtered and washed with cold alcohol. The recrystallization was repeated three times. . . . . Solution was effected (for use, as indicator) by dissolving in strong acetic acid, and diluting to an appropriate volume. One gram per liter is convenient.

J. A. CHASE.

Chicago, Ill., May 20, 1913.

Calculation of Extraction in Cyanide Plants

In the third article on "Silver Cyanidation at Tonopah," by Herbert A. Megraw, in the JOURNAL for Mar. 8, 1913, there is expressed some doubt as to whether the method of calculating extraction is better than the old system based on samples of the mill heads. We are familiar with the trouble between the millman and the general manager when the head samples indicate extremes of extraction varying from 70% to 120%, but it is my opinion that the fault lies not in the mill, but in the assay office.

When treating a gold ore it is possible, due to the slight mixing the samples receive in crushing from 1¼ in. to the size that will pass a 60-mesh screen, for a particle of gold the size of the screen opening to pass in excess into the final assay sample or to be retarded and thrown away with the discard, causing an appreciable error in either case.

A 60-mesh Tyler screen has an opening of 0.221 mm., and the cube of this aperature is 0.01079 cu.mm. Assuming the gold in the ore to be 700 fine, silver, 250, and base, 50 (sp. gr. 7), then the specific gravity of the gold as it goes into the assay will be 16.61, and the value of the same per ounce, $14.62, when the silver has a value of $0.60 per oz. The weight of one of the cubical particles of gold that will pass a 60-mesh screen would be 0.01079 × 16.61, or 0.1792 mg. For assay 29,166 mg. is taken, and if a particle of gold the size of the aperture passes in excess into the final assay sample, or is retarded with the discard, there is 0.1792 × 14.62, or a value of $2.62 difference from the true assay, representing 26% on $10 ore.

In an all-sliming plant the screen tests will usually show about 80% through 200 mesh, 19 to 20% on 200 mesh, and 1% or so on 100 mesh. The tailing sample is certainly more intimately mixed in its passage through launders, agitators and filters, than would be economically possible for the head sample. For comparison I shall assume the cubical size of the screen opening, although it is certain that with effective treatment the metal in tailing is not fully exposed to the dissolving effect of the cyanide solution, but exists in the grains of quartz or sulphide in quantities much smaller than the inclosing grains. The cubical opening of a Tyler 200-mesh screen is 0.0004052 cu.m., and its weight, if a gold

cube, 0.00673 mg., with a value of $0.098, 80% by weight being taken as through 200 mesh, the value affecting the sample is $0.0784. The cubical opening in a 100-mesh screen is 0.002744 cu.mm., and its value is $0.67. This, with 20% of the sample on 100 mesh, gives a value which may affect the final result of $0.13. The small portion on 100 mesh, all of which will pass 80 mesh, cannot account for a difference of more than $0.01. The sum total giving a value of $0.22, which would have an effect of only 2.2% on extraction.

Having shown the value of the particles, it would not be amiss to show the number of sand and gold particles in each case, and their proportions. The specific gravity of tailing being about 2.6, the weight of a cubical particle that will pass a 60-mesh screen is 0.01079 × 2.6, or 0.02805 mg. In one assay ton there are 1,039,809 possible particles of this size. In ore assaying $10 and bullion worth $14.62 per oz., we have 0.684 mg. in one-assay ton, which divided by 0.1792, gives 3.817 particles of gold. Having 3.817 particles of gold that will pass the 60-mesh screen, there will be, to complete the assay ton, 1,039,785 particles of sand.

In the case of the slime the value is assumed proportional to the screen tests by percentage. With a total value of $0.50, the value of the minus 200-mesh material is $0.40, and the weight 25,332.8 mg. The weight of a gold cube equal in size to the aperture in a 200-mesh screen is 0.00673 mg., and $0.40 represents 0.02736 mg. Therefore, there are 4.065 particles of gold, and, consequently, 25,327.735 mg., exclusive of the gold. Then 25,327.735 divided by 0.0004052 × 2.6 gives 24,083,772 particles, exclusive of the gold.

With 19% on 200 mesh, the weight is 5541.5 mg., and the weight of the gold cube the size of the screen opening is 0.04558 mg., giving actually 0.1462 particles of gold in this part of the sample; 5541.54 mg., minus 0.0065 mg., gives 5541.5335 mg., which, divided by 0.002744 × 2.6 gives 776,734 particles, exclusive of the gold.

On 100 mesh there is 1% containing $0.005, and weighing 0.00034 mg., the cubical opening of an 80-mesh screen is 0.005178 cu.mm., and the weight of the same cube of gold is 0.0756 mg. Therefore, 0.00034 divided by 0.0756 gives 0.0045 particles of gold, which may remain on 100 mesh. There are then 291.66 mg. minus 0.00034 mg., or 291.6596 mg. of sand, and 291.6596 divided by 0.005178 × 2.6, or 21,664 particles besides those of the gold.

To sum up these facts, we have, in heads, 3.817 particles of gold, and 1,039,785 particles of sand, or a ratio of 1 to 271,800, and in tailing 4.2115 particles of gold, and 24,882,170 particles of sand, or a ratio of 1 to 5,908,000. From the ratio of gold particles to sand particles, the chances of having an error in the head sample as compared with the tail sample is about 21½ times as great.

Of the usual head sample only one is taken, while with tailing a sample is generally taken from each cycle, at least four samples a day, and any discrepancy in one is partly compensated by the assayer when he takes the mean of the four.

Tons stamped, and tons discharged may not be the same, but under proper operating conditions the results over a period of 12 months will not indicate enough of a difference to justify a suspense account.

Providing there are no mechanical wastes of slime or solution, except in the regular filter discharges, then the value of bullion, plus the value of tailing discharged, divided by the number of tons treated, should give a closer true value of each ton of ore than the older methods.

A. G. CADOGAN.

Puntarenas, Costa Rica, Apr. 25, 1913.

Crushing Tonopah Ores

The following data relative to crushing Tonopah, Nev., ore by rolls may be of interest in the discussion of the subject invited by H. A. Megraw in his article, recently published in the JOURNAL. A set of 10x30-in. Allis-Chalmers rolls was among the equipment of the crushing and sampling department of the Desert Power & Mill Co. These rolls were in operation four years, from December, 1906, to January, 1911, and during that time reduced 29,873 tons of ore, which was 5% of the entire tonnage, cut out by a Snyder sampler. The roll feed was the same as that going to the stamp batteries, varying in size from slime to pieces of ore 2 in. in diameter, this size depending upon the condition of the 4D crushers. The maximum size of the roll product varied between ½ and ⅝ in., depending upon the opening between faces of the rolls. However, usually the reduction would be about 50%. The average time run per day was 5 hr. for a total of 1195 days in operation.

The power is estimated at 10 hp. and on that basis would amount to a total of 44,573 kw.-hr., which, at $0.0152 per kw.-hr., gives the total power cost $677.52, or $0.0227 per ton of ore reduced by rolls. It is estimated that one-fourth of one man's time at $4.50 per 8-hr. shift, or $0.703 for five hours, a total of $840.09, or $0.0281 per ton, is a fair allowance for the labor of operating the rolls during the 1195 days. Roll shells were refaced in a lathe and five changes were made; 2¾ sets were worn out during the period of operation. The roll shells weighed 757 lb. each, so that the total consumption of steel amounted to 4163.5 lb., or 0.14 lb. per ton of ore reduced. The rolls were operated at 103 r.p.m., which gives a peripheral speed of about 800 ft. per minute.

REPAIR COST FOR ROLL OPERATION

Labor changing rolls @ $20.00, per set	$100.00
10 roll shells turned, 6 hr., each @ 69c. per hr.	41.40
80 ft. of 10-in. belt @ 96c.	77.20
General repairs to feeder, belt, liners, etc.	100.00
8 bearings babbitted @ $5.00 for labor	40.00
Cost of babbit @ $10.00 each	80.00
2¾ sets of shells @ $146.62 per set	$403.20
Total	$841.80
Per ton of ore reduced	0.0282

SUMMARY

	Total	Per Ton Reduced
Repairs and upkeep	$841.80	$0.0282
Labor of operating	840.09	0.0281
Power used	677.52	0.0227
Total	$2359.41	$0.0790

It will be noticed that some of the above figures are based upon estimates, but it is believed that the estimates are liberal. I have had the impression that rolls can be used to advantage in the milling of Tonopah ore and am of the opinion that a thorough test and comparison would show a saving in initial cost of installation as well as in operating expense, and would welcome the publication of the figures obtained by A. H. Jones when he was investigating the subject of roll crushing before stamps were decided upon for the new Belmont mill.

A. R. PARSONS.

Monrovia, Calif., May 13, 1913.

EDITORIALS

Copper Production

The mine and smelter production of American works in March, according to our own statistical compilations, was 138,688,751 lb. Comparing the smelters' and refiners' figures for the first quarter of 1913 we have the following:

Month	Smelters	Refiners
January	137,776,472	143,479,625
February	125,781,865	130,948,881
March	138,688,751	136,251,849
Totals	402,247,088	410,680,355

The smelters' figures ought to run a little over the refiners' figures on account of copper going into bluestone and some other reasons. The fact that they aggregated less than the refiners' figures during the first quarter of 1913 indicates that the refiners were still working on old stocks carried over from 1912, which by this time ought to be wholly worked up. The average quarterly production of the smelters in 1912 was about 414,000,000 lb. Consequently, they are this year producing at a materially smaller rate.

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The Efficiency of Labor

The bureaus at Washington are gifted with the ability to produce reports of the character wanted, and about when wanted—at least it seems so. Thus, just when the tariff bill reaches a critical stage, when Secretary Redfield is issuing mandates that wages must not be reduced and when the protected interests, shortly to become unprotected, are vociferating once more, the Bureau of Foreign and Domestic Commerce produces a report of a study of 17 selected industries, as practiced in the United States and in Great Britain. The gist of this report is that American labor is more efficient than British. To do the same work in the industries examined, 18% more power and 2½ times more labor are required in Great Britain than in the United States. Consequently American manufacturers can pay a rate of wages twice as high and still come out ahead.

We are disposed to take these figures *cum grano salis,* especially when we note that on their American side they are based upon census returns. If the census returns consulted are of the same character as the mining and metallurgical figures, we imagine that almost anything might be made out of them that anybody pleased. Indeed, it takes somebody like a Philadelphia lawyer to make head or tail out of that particular report. Perhaps the Bureau of Foreign and Domestic Commerce consulted a Philadelphia lawyer.

However, whether American labor is 2½ times more efficient than British, or 2.4 times, or some other figure, we have no doubt that something of that sort is true and has been true for a long time, not perhaps in every industry, but in many. The comparative superiority of American labor, not meaning the individuals but rather the whole organization, and not comparing merely with Great Britain, is, of course, the explanation of how we can mine the lowest grade of copper ore, pay the highest rate of wages, transport the product 2000 miles by railway and 3000 by steamship and dominate the markets of Europe.

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Two Hoisting Accidents and Their Lesson

Two hoisting accidents at two of the larger metal mines of the United States, recently occurring within a few weeks of each other under similar circumstances, teach lessons interesting, though, in the one case, costly in loss of life. We refer to the dropping of the cages at the Ellison shaft of the Homestake Mining Co. and at the No. 1 shaft of the Leonard mine of the Anaconda Copper Mining Company.

At the Ellison hoist, a cage loaded with four 1-ton cars of ore was being hoisted, and, when between the 300- and 400-ft. levels, the clutch on the hoisting engine broke and the cage dropped, causing the freed reel to unwind so rapidly that the brakes, when applied, were powerless, and the cage crashed through a bulkhead of 12x12-in. timbers on the 1700-ft. level, and brought up on a similar bulkhead 150 ft. below. The cable broke from the reel, breaking two spokes and a part of the rim.

At the Leonard mine, the west cage was stationary at the 1400-ft. level, 10 men being on the decks, ready to be raised to the 1300. The east cage was at the surface, four men being on the decks. The hoisting engineer started to lower the east cage to the 60-ft. level on the brake with the reel unclutched, but the rod connecting the steam brake-operating device with the controlling lever broke, and the brake failed to grip. The loose reel gained such speed that, when the engineer attempted to stop it by throwing in the clutch, the latter broke, and the reel continued to accelerate until it burst; flying pieces broke the connections on the west brake and the west cage at the 1400-ft. level began to drop just as the east cage crashed past. The two men on the lower deck of the west cage succeeded in jumping into the station; the other eight men dropped to the bottom, about 800 ft., being injured, but not killed; the four men in the east cage were instantly killed. The best evidence is to the effect that the west cage did not drop freely, because the reel was still clutched to the shaft, and the safety dogs were released enough to cause some braking. The bursting reel wrecked the hoist room and one man at the surface was killed by flying wreckage.

From these accidents, it appears that the drag of an unwinding cable, or one whipping about in the shaft, gives sufficient tension to keep the safety dogs on the cage out of action. When once these conditions are established, no safety device would seem to be applicable. Much can be done, however, toward preventing any such high speed, with the engine out of control. Although it is against the rules at most mines, as it was at the Leonard, an engineer will occasionally lower men on the brake

rather than start or reverse his engine with both drums or reels clutched in. The safety of the men then rests entirely upon the integrity of the brake.

The accidents under consideration clearly indicate the necessity of additional safety devices to prevent a cage dropping, in case control of the hoisting engine is lost. The breaking of the controlling mechanism at the Leonard hoist suggests that the force applied to bring the brakes into action should be infallible; it should be gravity so acting through a weight that the human-controlled power, such as steam, electricity or compressed air should only release the brake by working against the weight, and in case of failure of man or mechanism, the weight should apply the brake immediately but gradually so as not to risk snapping the cable.

Safety in hoisting demands that human control be necessary to the motion of the cages, not to their stopping; failure of the man should result in rest, not motion. In reflecting upon the Leonard accident in particular, it would seem that the principle of the centrifugal governor could be used to prevent a reel or drum from exceeding a certain speed in either direction, by acting upon the brakes and the prime mover, thus making a runaway reel almost an impossibility. Further independence from human control could be effected by making the operation of the hoist dependent entirely upon the grip of the engineer, so that, should he become stricken on his platform, the involuntary release of his grip on the levers would cause the cages to come to rest, exactly as the most modern electric cars, such as those in the New York subway, come to a stop if the driver takes his hand from the controlling lever. Such control should be incorporated under compulsion in the design of even the smaller mine hoists.

The lessons taught at Butte and at Lead should stimulate the ingenuity of the designers and users of hoisting engines actually to construct some form of automatic control mechanism, such as has herein been suggested.

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The Wheat or the Chaff

It is well known that unprofitable mines are more numerous than profitable ones, but the relation between the two classes has never been reduced to figures save in the intemperate statements of the irresponsible promoter and the equally biased view of the speculator, who has lost his capital in a mushroom property. It is with particular interest, then, that we study the reliable figures furnished by the Canadian Mining & Exploration Co., Ltd., which is searching for mining property worthy of acquiring and exploiting. During the eight months' operations of this company, 428 properties have been examined, reported on and rejected, not one combining intrinsic merit and proportionate purchase price. The mines offered were in Canada, the United States, and Mexico, in the proportion of about 13:5:1, with a few others scattering. It is to be noted that among the large number of properties offered, there is a substantial number always presented to new buyers; properties which have long been in the market, and whose owners are periodically hopeful of getting rid of them. This class must form the bulk of the first work of an examining board of engineers. While the record of the Canadian company is not a gage of the relation of worthless to valuable mines, it may furnish a valuable indication of the amount of dead work to be performed by exploring engineers.

The record of the next year's work of the examining engineers will be more interesting. It is to be expected that fewer properties will be submitted and that some of them will be accepted, giving a better idea of the relation between the good and bad mines. The great lesson to the mine owner, however, and to the public, is that a worthless mine or one whose cost is clearly in excess of its value, cannot be sold in the present era of conscientious and careful examination.

The exploration department of the United States Smelting, Refining & Mining Co. examined 694 properties in 1912, of which 537 were turned down after an office examination of the reports. A preliminary field examination settled 121 more, while 36 were encouraging enough to warrant complete sampling and examination. Of these two were bought, and controlling interest acquired in two more, all coal mines.

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Missed Holes

Of the fatal accidents in United States metal mines for 1911, 11¼% were explosive accidents. This figure, from the Bureau of Mines report by Albert H. Fay, is not further subdivided into causes, but it is a safe guess that old man Missed Hole made his usual tally. In considering the subject of misfires and the means of abating the dangers attendant on them; their prevention, their detection and their handling when discovered, are all points of importance. The matter of handling them is one of the moot subjects in mining practice, one that can usually be depended upon to start an argument in a group of practical miners. The JOURNAL invites discussion of this point.

Should a missed hole be dug out, or should a new hole be drilled adjacent, or should a new primer be inserted on the charge when possible, and an explosion thus produced? What has been your experience, what is the practice in your district?

We know of one well managed mine where the foreman often pulls the fuse and detonator from the missed charge when discovered, and so far as we know, no accident from such cause has ever occurred. To the ordinary observer, however, this would appear a dangerous proceeding. It is often a stipulation in codes of rules and regulations that a hole must be drilled adjacent to the missed hole and charged and fired. Usually, this will explode the missed charge also and render it harmless, but it may merely scatter the contained powder into the muck. Furthermore, there is always the danger of miscalculating the angle of either the old or the new hole and drilling into the charge. Exploding a new primer on top of the old charge, provided there is no tamping, is an effective and safe way of eliminating the danger. If tamping is used, it should not be extremely hazardous to extract it, if care be exercised, so as to place the primer next the charge. It should be noted that of these various methods, pulling out the primer and extracting the charge is the quickest and cheapest and that which includes drilling a new hole is the most expensive.

Unquestionably, as with many other undesirable things in this world, complete elimination of "missed ones" would be most desirable. It is probable, however, that such complete elimination is not attainable and as long as missed holes are with us, how shall we treat them?

BY THE WAY

A new metal-extraction process starts casually by mixing concentrated sulphuric acid and potassium chlorate, which are then heated. What is the employers' liability-insurance rate in plants using this process?

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We note with interest a contemporary's statement that the scum on nickel electrolytes consists of iron in the form of cuprous hydroxide. Sir William Ramsey can get all the data on transmutation that he wants from this source.

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Touching upon the economies effected by the U. S. Steel Corporation, Mr. Farrell said that a concentrating plant, which cost $1,400,000, had saved 100,900,000 tons of ore on the Mesabi that would otherwise have been unavailable. The blast furnaces at Gary run 92 gas engines, which save 3,500,000 tons of coal per annum. The slag from the blast furnaces makes 10,000,000 bbl. per annum of slag cement, which sells at 90c.@$1 per barrel.

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As a result of the recent fire in the Survey building, a "fire sale" of geologic folios has been announced. The basement in which the folios were stored, was filled with dense smoke and many of the folios were burned, others scorched, and all more or less damaged by water. The entire remaining stock of about 150,000 folios, four-fifths of which are probably as near perfect as goods usually offered in a smoke or fire sale, will be sold at the nominal price of 5c. each. On probably 50,000 to 100,000 copies, the damage is practically negligible. The regular retail price of the standard folios is $0.25, and a few unusually large folios have been sold for $0.50, while the regular price of the "field edition" of the later folios is $0.50. No wholesale rate, however, applies to this fire sale. This would seem to be an excellent time for students, engineers, and the public generally, to order geologic folios, the 188 numbers of which fully describe the geology of about 175,000 square miles of the United States. Lists will be sent on application. Remittance should be made by money order or in coin.

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The Civil Service Commission announces an examination for electrometallurgist, on June 18, 1913, to fill a vacancy in the Bureau of Mines, for service in the field, at a salary from $1500 to $1800 per year. The following subjects will have the relative weights indicated: (1) Practical questions in electrometallurgy, 40; (2) general education and scientific training, 30; (3) professional experience and fitness, 30.

An education equivalent to graduation from a college of recognized standing, such training to include courses in geology, chemistry, physics and metallurgy, and actual experience in electric-furnace work, are requisites for consideration for this position. Applicants possessing a knowledge of metal mining and metallurgical work, including smelting, will receive additional credit under subject 3. Applicants must be over 25 and under 40 years of age. This examination is open to all men who are citizens of or owe allegiance to the United States.

Persons who desire this examination should at once apply to the United States Civil Service Commission, Washington, D. C., or to the secretary of the board of examiners at any place mentioned in the list printed hereon, for application and examination Form 1312, electrometallurgist, male.

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During a long examination for the purpose of defining authoritatively all the technical and trade terms which are in constant use in the hearing, James A. Farrell seized an opportunity to point out in one or two instances how the U. S. Steel Corporation is an industrial benefactor, by reason of its policy "to do a general business regardless of conditions." He cited the case of cotton ties, which were such an unattractive product for the Trust's four or five competitors that the task of supplying the cotton men with what was needed to market their crop fell upon the United States Steel Corporation. "It is predicted that the next cotton crop will be 16,000,000 bales," said Farrell, "and that means that about $2,000,000 worth of ties will be required. The manufacturers of Germany and Great Britain have enough to do supplying Egypt and India and parts of Mexico. If it were not for the United States Steel Corporation this country's cotton crop would lie on the ground this year." In an explanation of the manufacture and use of steel piles, Mr. Farrell remarked that a part of the city of New Orleans owed its safety to the dispatch with which his company had responded to the Government requisition for material for the levees. "We got a rush order for 515 tons of steel piles on one Thursday," he said, "and in spite of the fact that we were very busy, we gave preference to the Government work, and delivered the piles on the following Tuesday, days before the crest of the high water arrived."

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Apropos of the divining rod, Dr. M. E. Wadsworth, of the Michigan College of Mines, sends us a copy of the following communication by him, which was printed in the *American Geologist*, of January, 1898:

The review in "Nature" (Oct. 14, 1897, pp. 568-569) of a publication relating to the "divining rod" recalls to my mind a purely mechanical theory of that rod, which was given me years ago by a friend. This theory has been repeatedly tested by me and shown to be correct in the presence of my classes. The process is exceedingly simple. Take any forked twig of reasonably tough fiber in the clenched hands with the palms upward. The ends of the limbs forming the twig-fork should enter the closed fist on the exterior side of each fist, i.e., on the two sides of the clenched hands furthest from each other. When a twig is grasped in this position it will remain stationary if held loosely or with only a moderately firm grasp, but the moment the grasp is tightened the pressure on the branches will force the end of the twig to bend downward. The harder the grip the more it must curve. The curvature of the twig is mechanically caused by the pressure of the hands forcing the limbs to assume a bent and twisted position; or the force that causes the forked limb to turn downward is furnished by the muscles of the hands, and not by any other cause. The whole secret of the divining rod seems to reside in its position in the hands of the operator, and in his voluntarily or involuntarily increasing the closeness of his grasp on the two ends of the branches forming the fork. If the above conditions are fulfilled, the twig will always bend downward—water or no water, mineral or no mineral. Any one can be an operator, and any material can be used for the instrument, provided the limbs forming the fork are sufficiently tough and flexible. It can be easily understood how an ignorant operator may deceive himself and be perfectly honest in supposing that some occult force, and not his hands, causes the fork to curve downward.

The above is in line with the theory that the dowser experiences symptoms about when and where he thinks he ought to.

Francis T. Havard

The University of Wisconsin, and especially the Colege of Engineering, has suffered a great loss in the death of Professor Francis T. Havard, Associate Professor of Metallurgy, who had been with the University for four years. He was taken ill with pneumonia in April last and had apparently conquered the disease when general toxemia intervened, against which he was unable to rally, and the end came on May 22, at the Madison General Hospital.

Mr. Havard was born at Ipswich, Australia, Oct. 19, 1878. After his grammar-school training he entered Sydney University with advanced standing, and in 1897 went to the Bergakademie, Freiberg, Saxony, graduating from there as a metallurgical engineer in December, 1901. Immediately thereafter he came to the United States and entered the employment of the Boston and Montana Company at Great Falls, Mont., in the capacity of chemist and furnace foreman. In 1903 he accepted the position of manager of the smelting works of the Anhalt Lead & Silver Mining Co., in Germany, in which he had unique experience in successfully handling a wide variety of metallurgical products. In 1906 Mr. Havard accepted the management of the smelting works of the Copiapo Mining Co. in Chile, returning to the United States in 1908, when he was engaged in some special metallurgical work for the U. S. Metals Refining Company and others.

Mr. Havard went to the University of Wisconsin in the fall of 1909, and his record of technical, educational and social achievement there is known to a wide circle of friends. In 1908 he married Miss Margaret Raleigh, of Helena, Mont., and he is survived by his wife and one son.

Mr. Havard was a man of rare personality, of cosmopolitan culture and scholarly ability. His genial humor, broad sympathies and high ideals were an inspiration to all who were privileged to know him. For many years he was a valued contributor to the JOURNAL and to "The Mineral Industry." In his writings he exhibited a clear discernment and the possession of a polished literary style. His recently published treaties on "Refractories and Furnaces" has attracted wide and favorable attention. Mr. Havard was a member of the Mining and Metallurgical Society of America.

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Production of Low-Carbon Nickel Alloys

A process for the production of low-carbon nickel alloys, especially ferrochromium, containing nickel and ½ to 2% of carbon, is covered by U. S. pat. 1,059,709, granted to Eugene A. Byrnes, of Washington, D. C., assigned to the Electrometallurgical Co., of Chicago, Ill. The process is a two-stage one. In the first stage a product relatively high in carbon is made, for example, the crude ferrochromium commonly produced by electrically smelting a mixture of chromite, carbon and a flux contains from 5 to 10% of carbon. The high-carbon product is then subjected to the action of an oxide of nickel, while heated to such temperature as to effect a reaction between its contained carbon and the nickel oxide. This secondary process is, however, carried on at a temperature lower than that required to produce the crude ferrochromium. The process may be carried out either by stirring nickel oxide into a molten body of the high-carbon metal or alloy, by feeding the nickel oxide into a bath of inert slag, for example, calcium aluminate supported by the crude metal or alloy, by contact with nickel oxide, or by melting a mixture of the broken crude metal or alloy with nickel oxide.

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Two Views of the Copper Trade

During a period of general pessimism in finance and some undoubted recession in business in the United States, reflected among other things by a sagging in the iron market, copper has been the brightest thing and has furnished evidence that no one has been able to reconcile with prevailing ideas. Early in the year it was said that the copper manufacturers were running on their old orders, and were busy to be sure, but things would be different shortly. Since then months have rolled by and the gloomy prognostications have not come true. On the contrary the copper trade has continued very good and gives no signs of slackening. In this connection the recently expressed opinions of two well known concerns are enlightening.

Henry R. Merton & Co. write from London, under date of May 10:

> From the enormous deliveries made to the trade, it might be inferred that consumers have begun to fill up their entirely depleted warehouses; but in view of the constant clamor for immediate delivery of metal which still comes from all quarters, the indications show that every ton of copper delivered is going straight into consumption, and that stocks in manufacturers' hands are still at the lowest ebb. Any further shrinkage of stocks will bring us face to face with the conditions which prevailed a year ago. At that time there was still a comfortable amount of copper in consumers' hands, and there was also the prospect of an increasing production. Today, notwithstanding that increased production having materialized, the reserves in consumers' hands are exhausted, the visible supplies are extremely small and diminishing, and the outlook for a fresh increase in production during the present year is very problematical. Should the consumption of copper remain on the present enormous scale there would, therefore, undoubtedly be a very small margin of marketable copper at the disposal of the trade. This question of the maintenance of the industrial activity is thus of the greatest importance in judging the future course of the copper market; but the answer to the question is at the moment very difficult. In some quarters a falling-off in trade is predicted, and it must be admitted that the prolonged unsettlement of European politics has interfered with some branches of business already, but in other directions, especially in the electrical industry, we see nothing but continued expansion, while in the engineering and shipbuilding trades activity remains assured for a considerable period to come.

The National Conduit & Cable Co., of New York, says, under date of May 20:

> Domestic consumption continues on a large scale, and this favorable feature of the situation has contributed material strength to the market. The heavier export movement which set in in such pronounced fashion during March continued during April and is still in active progress. Europe has demonstrated her ability to absorb all the metal this country can possibly ship without creating any serious pressure on foreign consumptive capacity. Despite recent enormous exports European copper prices improved lately, and it looks as if Europe is perfectly able to take care of all the copper the United States can spare. The remarkable shipments indicate the extent and importance of the European demand for American copper. It is not probable that the entire amount exported has gone directly to consumers, but even admitting that a portion of the shipments represent consignments awaiting future disposal, there is no denying the fact that European consumption is at a rate requiring a steady stream of American supplies in

heavy volume. This view of the case is no guesswork. Domestic consumption is maintained in large volume, and as measured by the tonnage delivered to manufactures in April it shows that the copper and brass business of the country is going along in an encouraging way. If the present rate of home consumption and export shipments can be maintained the danger to market stability should be reduced to a minimum. Present prices allow a reasonable profit for production and around the current level are apt to prove more satisfactory to all concerned than fictitious or extraordinary values which ultimately disturb the equilibrium of trade.

Government Action against Smelting Trust Probable

WASHINGTON CORRESPONDENCE

It is understood that the Department of Justice is carrying on another more or less careful survey of the organization of the American Smelting & Refining Co., and that at an early date proceedings will probably be opened against that company, probably with special reference to its connection with the American Smelters' Securities Co. Precisely what the scope of the proceedings will be is still a secret, but the fact that the preparations are being made as just indicated seems to be generally accepted.

It will be remembered that the same subject was investigated with care by Attorney-General Wickersham, who later reported to the House of Representatives, in response to an inquiry, that he had not found anything in the situation to warrant a charge that a trust existed in connection with metals. The present administration is understood not to approve of the work done by the Department of Justice under the preceding administration, and to be disposed to make a radical departure from it.

The American Iron & Steel Institute

The annual meeting of the American Iron & Steel Institute was held in New York, May 23. There were three sessions, all largely attended. The morning session was opened by an address from President E. H. Gary, who spoke at some length on the modern tendency to regulate business by legislation. He deprecated much of this law-making, which was necessarily in large part the work of inexperienced and unqualified men. He also referred to the tendency of recent legislation to produce class feeling. With regard to business, he took a hopeful view, urging that the necessities of the country demanded a constantly increasing supply of materials and that there was every reason to suppose that the purchasing power of the country was increasing and that the effects of this would be felt in the iron and steel trades. He urged, as in previous addresses, coöperation and mutual good feeling and assistance.

Following this address, papers were read and discussed as follows: "Gas Engines," by H. J. Freyn; discussed by Arthur West and R. H. Rice. "Ore Reserves on the Eastern Mesabi," by George A. St. Clair; discussed by Sheldon Norton. "Importance of First-Aid-to-the-Injured," by Dr. W. O'Neill Sherman; discussed by Dr. John B. Lowman. "What Causes Fatigue," by Dr. Thomas Darlington.

At the afternoon session the time was wholly given to the reading of papers and discussion. The papers presented were: "Byproduct Coke Ovens," by Carl A. Meissner; discussed by W. H. Blauvelt, Christopher G. Atwater and Oscar Simmersbach. "Claims and Their Adjustment," by George P. Early. "Practical Value of the Microscope in the Iron and Steel Industry," by Prof. Albert Sauveur; discussed by Bradley Stoughton, John S. Unger and George W. Sargent. "Transportation on the Great Lakes," by Harry Goulby; discussed by Antonio C. Pessano.

The third session was the annual dinner in the evening. Incidentally there was a paper on the "Tendencies in Technical Education," by Prof. Frederick Crabtree. Judge Gary made a brief address, emphasizing his remarks of the morning and a number of other short addresses were made, the most important speakers being James A. Farrell, Charles M. Schwab, Joseph G. Butler, Jr., and James H. Hoyt. Mr. Schwab referred humorously at some length to his recent experiences before the examiners in the Steel Corporation suit.

At the suggestion of Mr. Butler, the diners drank a silent standing toast to the memory of their former honorary member, J. Pierpont Morgan, whom Mr. Butler characterized as perhaps the greatest American of the nineteenth century.

The Presidency of Stanford University

Dr. John Casper Branner, dean of the department of geology and mining and vice-president of Stanford University, has been selected for president of the University to succeed Dr. David Starr Jordan, who becomes chancellor. The purpose of the advancement of Doctor Jordan is to allow him to represent more fully the university in its functions toward the public and its relations to educational agencies outside of the university. The position of chancellor was created by the board of trustees on May 23, when the official change took place. Doctor Jordan has occupied the position of president of Stanford since 1891, when he resigned from the position of president of the Indiana State University, which he had held from 1885. He was a member of the pioneer class of Cornell, and took his degree in 1872. Later he took up the special study of zoology and became prominent in investigations of the fish industry. Doctor Branner came to Stanford also in 1891, and had been a member of the faculty of the Indiana State University under Doctor Jordan. The personal relations and friendship between the two men extend through a period of 43 years. Doctor Branner has been long noted as a geologist, and was the fourth American professor of geology to receive the Hayden medal, awarded by the Philadelphia Academy of Sciences to geologists who had accomplished leading work in the profession. He also was a graduate of Cornell. In accepting the presidency of Stanford, Doctor Branner will not relinquish his activity and interest in the department of geology, but will continue instruction in some of the higher courses. The announcement of the advancement was made at the conclusion of the commencement exercises on May 19. Doctor Jordan will visit Europe this summer to study conditions in the Balkans and Alsace-Lorraine.

Reported in New York

The $15,000,000 of bonds of the Chile Copper Co. were all taken by private subscription.

William A. Clark is going to put up a zinc-concentrating mill of 350 tons, daily capacity at Butte, Mont., using the Minerals Separation process.

Mining Companies—United States

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest	Amt
Acacia, g.	Colo.	1,438,989	$ 1	$ 129,618	Jan. '11	$0.01
Adams, s.l.c.	Colo.	80,000	10	778,000	Dec. '09	0.04
Ahmeek, c.	Mich.	50,000	25	1,700,000	Apr. '13	7.00
Alaska Mexican, g.	Alas.	180,000	5	3,129,381	Feb. '13	0.20
Alaska Treadwell, g.	Alas.	200,000	25	12,985,000	Feb. '13	1.00
Alaska United, g.	Alas.	180,200	5	1,288,930	Feb. '13	0.70
Am. Zinc, Lead & Sm.	U. S.	165,360	25	985,820	Apr. '13	0.50
Anaconda, c.	Mont.	4,332,500	25	74,919,375	Apr. '13	0.75
Argonaut, g.	Cal.	200,000	5	1,200,000	June '10	0.05
Arizona Copper, pf.	Ariz.	1,426,120	1.20	1,777,169	Apr. '13	...
Arizona Copper, com.	Ariz.	1,519,896	1.20	15,429,473	Feb. '13	0.48
Bagdad-Chase, g., pf.	Cal.	84,819	5	202,394	Jan. '09	0.10
Baltic, c.	Mich.	100,000	25	7,050,000	June '11	5.00
Bingham N. H., c.	Utah.	228,690	5	294,219	July 12	0.10
Bonanza Dev., g.	Colo.	300,000	1	1,425,000	Oct. '11	0.20
Bunker Hill Con., g.	Cal.	200,000	1	731,000	Apr. '13	0.05
Bunker Hill & Sul., l.s.	Ida.	327,000	10	14,173,350	Apr. '13	0.20
Butte-Alex Scott, c.	Mont.	74,000	10	74,000	Nov. '12	0.50
Butte & Ballaklava, c.	Mont.	250,000	10	125,000	Aug. '10	0.50
Caledonia, l.s.c.	Ida.	1,300,000	1	52,000	June '10	0.01
Calumet & Arizona, c.	Ariz.	596,353	10	16,969,000	Mar. '13	1.25
Calumet & Hecla, c.	Mich.	100,000	25	121,050,000	Mar. '13	10.00
Camp Bird, g.s.	Colo.	1,100,051	5	9,383,512	Jan. '13	0.24
Centen'l-Eur., l.s.g.c.	Utah.	100,000	5	3,750,000	Mar. '13	1.50
Center Creek, l.z.	Mo.	100,000	10	420,000	Jan. '13	0.05
Champion, c.	Mich.	100,000	25	7,900,000	Apr. '13	1.00
Cliff, g.	Utah.	300,000	1	120,000	Jan. '13	0.10
Cliff, g.	Alas.	100,000	1	180,000	Nov. '12	0.05
Colo. Gold Dredging.	Colo.	100,000	10	200,000	Nov. '12	0.25
Colorado, l.s.g.	Utah.	1,000,000	0.20	2,570,000	Dec. '12	0.03
Columbus Con., g.s.	Utah.	285,540	5	226,832	Oct. '07	0.20
Commercial Gold.	Ore.	1,750,000	1	43,750	Dec. '10	0.00½
Con. Mercun., g.	Utah.	1,000,000	1	3,415,313	July '12	0.03
Continental, z. l.	Mo.	22,000	25	286,000	Jan. '13	0.50
Copper Range Con., c.	Mich.	393,445	100	13,491,089	Apr. '13	0.75
Daly Judge, s.l.	Utah.	300,000	1	540,000	Mar. '13	0.15
Daly West, s.l.	Utah.	180,000	20	6,606,000	Jan. '13	0.15
Doctor Jackpot, g.	Colo.	3,000,000	0.10	45,000	Mar. '11	0.00½
Doe Run, l.	Mo.	65,782	100	3,237,869	Dec. '12	1.50
Elkton Con., g.	Colo.	2,500,000	1	3,079,460	Nov. '12	0.02
El Paso, g.	Colo.	490,000	5	1,658,545	Mar. '13	0.12½
Ernestine, g. s.	N.M.	300,000	5	400,000	Dec. '12	0.00½
Fed. M. & S., com.	Idaho.	60,000	100	2,708,750	Jan. '09	1.50
Fed. M. & S., pf.	Idaho.	120,000	100	8,848,268	Mar. '13	1.50
Florence, g.	Nev.	1,050,000	1	840,000	Apr. '11	0.10
Frances-Mohawk, g.	Nev.	912,000	1	546,000	Jan. '08	0.05
Free Coinage, g.	Colo.	10,000	100	180,000	Dec. '09	1.00
Fremont Con., g.	Calif.	200,000	2.50	186,000	Apr. '13	0.02
Frontier, z.	Wis.	1,250	100	156,272	Mar. '13	2.00
Gemini-Key'ne, l.g.s.	Utah.	5,000	100	2,060,000	Nov. '12	6.00
Gold Chain, g.	Utah	1,000,000	1	100,000	Feb. '13	0.03
Gold Coin of Victor.	Colo.	1,000,000	1	1,350,000	Feb. '09	0.02
Gold Dollar Con.	Colo.	2,500,000	0.10	100,000	Dec. '12	0.00½
Gold King Con., g.	Colo.	5,750,370	1	1,407,319	Dec. '11	0.03
Golden Cycle, g.	Colo.	1,500,000	5	2,381,000	Apr. '13	0.02
Golden Star, g.	Ariz.	400,000	5	140,000	Mar. '10	0.05
Goldfield Con., g.	Nev.	3,558,367	10	24,906,811	Apr. '13	0.30
Grand Central, g.	Utah.	500,000	1	1,520,750	Apr. '13	0.05
Granite, g.	Colo.	1,650,000	1	269,500	Nov. '12	0.01
Hazel, g.	Cal.	900,000	1	873,000	Nov. '12	0.01
Hecla, l.s.	Idaho.	1,000,000	0.25	2,780,000	Apr. '13	0.02
Hercules, l.s.	Idaho.	1,000,000	1	3,650,000	July '11	0.06
Homestake, g.	S. D.	218,400	100	32,714,774	Apr. '13	0.65
Horn Silver, l.s.z.	Utah.	400,000	25	5,662,000	Sept. '07	0.05
Iowa, g.s.l.	Colo.	1,666,667	1	200,166	June '11	0.00½
Iowa-Tiger Leasing g.s.	Colo.	12,655	1	13,921	Jan. '12	0.10
Iron Blossom, s.l.g.	Utah.	1,000,000	0.10	1,570,000	Apr. '13	0.10
Iron Silver, s.l.g.	Colo.	500,000	20	4,700,000	Apr. '13	0.10
Jamison, g.	Cal.	390,000	10	378,300	Jan. '11	0.02
Jerry Johnson, g.	Colo.	2,500,000	0.10	150,000	Aug. '11	0.01
Kendall, g.	Mont.	500,000	5	1,475,000	Nov. '12	0.02
Kennedy, g.	Cal.	100,000	100	1,831,001	Apr. '10	0.03
King of Arizona, g.	Ariz.	200,000	1	396,000	Aug. '09	0.12
Klar Piquett, z.l.	Wis.	20,000	1	162,500	Dec. '12	0.50
Knob Hill, g.	Wash.	1,000,000	1	45,000	May '12	0.00½
Liberty Bell, g.	Colo.	130,551	5	522,093	Oct. '10	1.00
Little Bell, l.s.	Utah.	300,000	1	75,000	Mar. '11	0.05
Little Florence, g.	Nev.	1,000,000	1	430,000	Jan. '08	0.03
Mammoth, g.s.c.	Utah.	400,000	25	2,280,000	Oct. '12	0.15
Mary McKinney, g.	Colo.	1,309,252	1	1,025,188	Apr. '13	0.02
May Day, g.s.l.	Utah.	800,000	0.25	148,000	Feb. '13	0.03
Mexican, g.s.	Nev.	201,600	2.50	20,160	Aug. '11	0.10
Miami, c.	Ariz.	664,993	5	1,472,314	Feb. '13	0.50
Modoc, g.s.	Colo.	500,000	1	275,000	Dec. '11	0.01
Mohawk M. Co.	Mich.	100,000	25	2,975,000	Feb. '13	3.00
Monarch-Mad'a, g.s.l.	Colo.	1,000,000	1	40,000	May '11	0.01
Montana-Tonop., s.g.	Nev.	921,865	1	530,000	Dec. '12	0.10
Mountain, c.	Cal.	250,000	25	4,216,250	May '08	0.44
National, g.	Nev.	750,000	1	570,000	May '11	0.10
Nevada Con., c.	Nev.	1,999,394	5	11,488,196	Mar. '13	0.37½
New Century, z.l.	Mo.	330,000	1	237,600	Oct. '09	0.01
New Idria, q.	Cal.	100,000	5	1,700,000	Apr. '13	0.10
North Butte, c.	Mont.	410,000	15	10,865,000	Apr. '13	0.50
North Star, g.	Cal.	250,000	10	3,836,989	Mar. '13	0.20
Old Domin'n, M. & Sm.	Ariz.	162,000	25	2,956,000	Apr. '13	1.25
Ophir, s. g.	Nev.	201,600	3	2,068,360	Jan. '12	0.10
Opohongo, g.s.l.	Utah.	898,978	0.25	80,907	Jan. '13	0.02
Oroville Dredging.	Cal.	700,000	5	1,383,036	Dec. '09	0.12½
Osceola, c.	Mich.	96,150	25	11,458,550	Apr. '13	3.00
Parrot, c.	Mont.	229,850	10	7,186,826	Feb. '13	0.15
Pearl Con., g.	Wash.	1,909,711	0.05	181,422	Dec. '10	0.02
Pharmacist, g.	Colo.	1,500,000	1	87,500	Feb. '10	0.00½
Pioneer, g.	Alas.	5,000,000	1	4,041,526	Oct. '11	0.03
Pittsburgh-Idaho, l.	Ida.	803,000	1	216,810	Oct. '12	0.04
Pittsburgh Silver Peak, g.	Nev.	2,790,000	1	558,000	Mar. '13	0.02
Portland, g.	Colo.	3,000,000	1	9,277,080	Apr. '13	0.02
Quilp.	Wash.	1,500,000	1	67,500	Feb. '13	0.01
Quincy, c.	Mich.	110,000	25	20,595,000	Mar. '13	1.50
Republic, g.	Wash.	1,000,000	1	85,000	Dec. '10	0.01½
Rochester, l.z.	Mo.	4,900	100	188,396	Dec. '10	0.50
Round Mountain, g.	Nev.	866,426	1	328,404	Sept. '10	0.04
Seven Troughs Coal. g.	Nev.	1,500,000	1	37,500	July '12	0.02½
St. Joseph, l.	Mo.	1,000,000	$10	$ 8,708,357	Mar. '13	$0.15
Shannon, c.	Ariz.	300,000	10	750,000	Jan. '13	0.50
Shattuck-Arizona, c.	Ariz.	350,000	10	1,225,000	Jan. '13	0.50
Silver King Coal. l.s.	Utah.	1,250,000	5	2,159,885	Apr. '13	0.15
Sioux Con., s.l.g.	Utah.	745,389	1	872,097	July '11	0.04
Skidoo, g.	Cal.	1,000,000	5	275,000	May '12	0.02½
Smuggler, l.s.z.	Colo.	1,000,000	1	2,235,000	Nov. '06	0.03
Snowstorm, c.g.	Ida.	1,500,000	1	1,147,118	Apr. '13	0.01½
South Eureka, g.	Calif.	299,981	1	366,881	Apr. '12	0.07
Standard Con., g.s.	Cal.	178,394	10	5,229,809	Jan. '12	0.10
Stratton's Ind., g.	Colo.	1,000,000	0.60	425,250	Nov. '12	0.06
Success, z.	Ida.	1,500,000	1	910,000	Mar. '13	0.02
Superior & Pitts., c.	Ariz.	1,499,793	10	4,229,418	Mar. '13	0.38
Tamarack, c.	Mich.	60,000	25	9,420,000	July '07	4.00
Tennessee, c.	Tenn.	200,000	25	3,406,520	Jan. '13	1.50
Tomboy, g. s.	Colo.	300,000	4.85	2,993,760	Dec. '12	0.24
Tom Reed, g.	Ariz.	909,555	1	1,264,367	May '13	0.06
Tonopah Belm't, s.g.	Nev.	1,500,000	1	4,343,003	Apr. '13	0.25
Tonopah Ext., g.s.	Nev.	943,433	1	353,786	Jan. '13	0.02½
Tonopah of Nev., s.g.	Nev.	1,000,000	1	10,450,000	Apr. '13	0.40
Tri-Mountain, c.	Mich.	100,000	25	950,000	Dec. '10	1.00
Tuolumne, c.	Mont.	800,000	1	440,000	Feb. '13	0.10
Uncle Sam, g. s. l.	Utah.	500,000	1	495,000	Sept. '11	0.05
United Cop. Min., s.	Wash.	1,000,000	1	90,000	Apr. '13	0.01
United (Crip. Ck.) g.	Colo.	4,000,100	1	440,435	Jan. '10	0.04
United Globe, c.	Ariz.	23,000	10	1,184,500	Apr. '13	7.50
United Verde, c.	Ariz.	300,000	10	32,897,000	Apr. '13	0.75
Utah, s.l.	Utah.	100,000	10	325,000	Dec. '10	0.02
Utah, c.	Utah.	1,562,599	10	17,429,857	Mar. '13	0.75
Utah Con., c.	Utah.	300,000	5	7,650,000	Apr. '13	0.50
Valley View, g.	Colo.	1,000,000	1	240,000	Dec. '10	0.04
Victoria, g.s.l.	Utah.	250,000	1	207,500	Mar. '10	0.04
Vindicator Con., g.	Colo.	1,500,000	1	2,677,000	Apr. '13	0.03
Wasp No. 2, g.	S. D.	500,000	1	396,965	Feb. '13	0.02
Wellington Mines, g.	Colo.	10,000,000	1	210,000	Jan. '13	0.001
Wolverine, c.	Mich.	60,000	25	7,940,000	Apr. '13	5.00
Work, g.	Colo.	1,500,000	1	172,500	July '08	0.00½
Yak, s.l.	Colo.	1,000,000	1	1,417,685	Oct. '10	0.04
Yankee Con., g.s.	Utah.	1,000,000	1	167,500	Jan. '13	0.01
Yellow Aster, g.	Cal.	100,000	10	1,131,789	Apr. '13	0.05
Yellow Pine, l.z.s.	Nev.	950,000	1	199,508	Mar. '13	0.02
Yukon Gold, g.	Alas.	3,500,000	5	4,725,000	Mar. '13	0.07½

Coal, Iron, Industrial and Holding Companies

Amalgamated, c.	Mont.	1,538,879	$100	$74,351,472	Feb. '13	$1.50
Am. Sm. & Ref., com.	U. S.	500,000	100	23,833,333	Mar. '13	1.00
Am. Sm. & Ref., pf.	U. S.	500,000	100	43,731,333	Mar. '13	1.75
Am. Smelters, pf. A	U. S.	170,000	100	7,620,000	Apr. '13	1.50
Am. Smelters, pf. B	U. S.	300,000	100	11,607,000	Apr. '13	1.25
Cambria Steel.	Penn.	900,000	50	16,772,500	Feb. '13	0.62½
Greene Cananea.	U. S.	2,471,314	25	2,475,282	Mar. '13	0.25
Guggenheim, Expl.	U. S.	831,732	25	15,729,650	Apr. '13	0.62½
Inter'l Nickel, com.	U. S.	115,826	100	8,003,423	Mar. '13	2.50
Inter'l Nickel, pfd.	U. S.	89,126	100	3,873,125	Feb. '13	1.50
Inter'l Sm & Ref.	U. S.	100,000	100	2,900,000	Mar. '13	2.00
Lehigh Coal & Nav.	Penn.	482,956	50	22,535,092	Nov. '12	1.00
National Lead, com.	N. Y.	206,554	100	7,331,478	Mar. '13	0.75
National Lead, pf.	N. Y.	243,676	100	26,281,641	Mar. '13	1.75
Old Dominion, c.	Ariz.	293,245	25	3,946,918	Apr. '13	1.25
Phelps, Dodge & Co.	U. S.	450,000	100	24,059,304	Mar. '13	2.50
U. S. Steel Corp., com.	U. S.	5,083,025	100	181,696,289	Mar. '13	1.25
U. S. Steel Corp., pf.	U. S.	3,602,811	100	326,158,901	Feb. '13	1.75
U. S. S., R. & M., com.	U.S.-Mex.	486,320	50	5,045,525	Apr. '13	0.75
U. S. Sm., R. & M., pf.	U.S.-Mex.	351,105	50	12,114,165	Apr. '13	0.87½

Canadian, Mexican and Central American Companies

Ajuchitlan, g.s.	Mex.	50,000	$ 5	$ 200,000	Oct. '12	$0.25
Amparo, g.s.	Mex.	2,000,000	1	1,006,884	Feb. '13	0.04
B. C. Copper.	B. C.	591,709	5	615,398	Jan. '13	0.15
Beaver Con., s.	Ont.	1,996,490	1	409,879	Dec. '12	0.03
Buffalo, s.	Ont.	1,000,000	1	1,847,000	Feb. '13	0.03
Cobalt Townsite, s.	Ont.	1,000,000	1	210,000	Nov. '12	0.03
Coniagas, s.	Ont.	800,000	5	4,280,000	Nov. '12	0.45
Con. M. & S. Co. of Can.	B. C.	58,052	100	1,014,061	Oct. '12	4.00
Crown Reserve, s.	Ont.	1,768,814	1	4,952,680	Apr. '13	0.05
Crow's Nest Pass C. Co.	B. C.	248,506	25	2,182,864	Mar. '11	0.25
Dominion Coal, com.	N. S.	150,000	100	5,550,000	Jan. '13	1.00
Dominion Coal, pf.	N. S.	50,000	100	4,915,000	Aug. '12	3.50
Dos Estrellas, g.s.	Mex.	300,000	0.50	13,755,000	Mar. '13	2.50
El Oro, g.s.	Mex.	1,147,500	4.85	8,668,418	Dec. '12	0.24
Esperanza, s.g.	Mex.	455,000	4.85	11,664,608	Jan. '13	0.36
Granby, s.l.c.	B. C.	148,496	100	4,419,832	Mar. '13	1.50
Greene Con., c.	Mex.	1,000,000	10	8,044,400	Feb. '13	0.45
Guanajuato D., pf., s.	Mex.	10,000	1000	274,356	Jan. '11	3.00
Hedley Gold.	B. C.	120,000	10	924,000	Mar. '13	0.50
Hollinger, g.	Ont.	550,000	5	700,000	May '13	0.15
Kerr Lake s.	Ont.	600,000	5	4,470,000	Mar. '13	0.25
La Rose Con., s.	Ont.	1,498,407	5	3,888,491	Apr. '13	0.25
Le Roi No. 2, g.	B. C.	120,000	£4.30	1,471,580	Jan. '13	0.36
Lucky Tiger Com., g.	Mex.	715,337	10	1,754,030	Apr. '13	0.05
McK.-Dar. Sav. s.	Ont.	2,247,692	1	3,438,396	Apr. '13	0.10
Mines Co. of Am. (new).	Mex.	1,700,000	10	*1,102,500	Apr. '13	0.12½
N. Y. & Hond. Ros.	C. A.	150,000	10	3,112,500	Dec. '12	0.20
Nipissing, s.	Ont.	1,200,000	5	9,990,000	Apr. '13	0.37½
Peñoles, s.l.g.	Mex.	80,000	25	6,210,688	Mar. '13	1.25
Peregrina M. & M., pf.	Mex.	10,000	100	328,656	Sept. '10	3.50
Pinguico, pf., s.	Mex.	20,000	100	600,000	Oct. '11	3.00
Right of Way Mns†s.	Ont.	1,685,500	1	202,260	Dec. '11	0.02
Rio Plata, s.	Mex.	373,437	5	345,714	Feb. '13	0.05
San Rafael, g.s.	Mex.	2,400	25	1,439,780	Oct. '12	0.90
San Toy, g.s.	Mex.	6,000,000	1	420,000	Dec. '12	0.10
Sopresa, g.s.	Mex.	19,200	20	1,517,438	Jan. '11	34.00
Stand'd Silver-Lead.	B. C.	2,000,000	1	625,000	Apr. '13	0.02½
Timiskaming, s.	Ont.	2,500,000	1	1,534,155	Apr. '13	0.06
Tem. & Hud. Bay, s.	Ont.	7,761	1	1,753,986	Mar. '13	3.00
Trethewey, s.	Ont.	1,000,000	1	961,998	Jan. '13	0.10
Wettlaufer-Lorrain, s.	Ont.	1,416,590	1	566,636	Jan. '13	0.05

*Previous to reorganization, $5,258,881.
†Previous to January, 1910, $324,644.

PERSONALS

L. S. Austin, of Salt Lake City, has been visiting New York.

Harry J. Wolf has removed his Denver office from 640 Gas & Electric Building to 1123 First National Bank Building.

Frank G. Willis, has been appointed consulting engineer of the Mary McKinney Mining Co., at Cripple Creek, Colorado.

Dr. James Douglas,of New York, has forwarded a check for $25,000 to the Queen's School of Mining, Kingston, Ont., for the establishment of tutorships.

Henderson Scott and D. Gordon Smith, both of London, England, have joined the staff of engineers conducting exploration for the Breitung Mines Corporation, in Colombia.

Charles H. Clapp, at present a member of the Canadian Geological Survey, has accepted a position on the faculty of the School of Mines at the Arizona University, at Tucson.

J. W. H. Hamilton, of Hamilton & Hansell, left New York, May 24, on an extended European trip. He expects during this trip to assist in the starting of several new Greenawalt sintering plants in Europe.

W. S. Gebb, chief chemist and engineer for the Southwestern Miami Development Co., has gone to Bakersfield, Calif., to erect a cyanide plant for the Black Bob Gold Mining Co., of which his brother is manager.

A. B. Foote has succeeded his father, A. D. Foote, as general superintendent for the North Star Mines Co. A. D. Foote will serve as consulting engineer. William Hague will continue as managing director.

A. E. Drucker has resigned as consulting metallurgist to the Oriental Consolidated Mining Co., and has been appointed technical manager to the Concession Minière Francaise de Chang-Song, of northern Chosen.

Lloyd B. Smith, professor of geology in the Carnegie Institute of Technology at Pittsburgh, has resigned to enter the employ of the Associated Geological Engineers in the examination of oil and gas properties.

Huxley St. John Brooks, having severed his connection with the Pereira Gold Mines, Macequece, Portuguese East Africa, has joined the metallurgical staff of the Machavie Gold Mining Co., Potchefstroom, Transvaal.

M. T. Armas has recently joined the firm of DuBois & Mixer. His headquarters will be in Paris, France, but he expects to pass much of the time in South America, as he will have charge of the South American work of the firm. Mr. Armas is at present on his way to Bolivia.

John Birkinbine, C. K. Leith, Joseph Sellwood and Dwight E. Woodbridge are at Ironwood, Mich., called as expert witnesses in the case of the Newport Mining Co. vs. the State of Michigan. Dr. Leith is called for the state and the others for the company, which seeks to abate the Michigan tax assessment of 1911, and to overturn the system under which J. R. Finlay estimated taxable values of Michigan mines.

OBITUARY

Joseph Finley died at Denver, Colo., May 19, aged 56 years. He was one of the pioneers of the Cripple Creek camp, and was the locator and first owner of the Finley mine there.

John Fortuno died at Denver, Colo., May 7, aged 69 years. He was born in New Brunswick and educated as a civil engineer. After working on the construction of several railroads in Wisconsin and Minnesota, he went to Colorado and engaged in mining. For many years he was engaged in mining in Park County on a large scale, having charge of the Alma placers, and later he had charge of the Tarryall properties in the same county. As an expert he had visited nearly every placer district in the world, and his reports were highly valued. He made and lost several fortunes in mining ventures, and at his death was the owner of several properties reputed very valuable.

W. D. Mullan, popularly known as "Slim" Mullan, one of the pioneers of mining in Northern Ontario, died recently at Buffalo, N. Y., following a surgical operation. He was a native of New Brunswick and after considerable experience in Nevada, Montana and other Western mining camps, joined the Yukon rush in 1896, but was comparatively unsuccessful. He was one of the first in the field in Cobalt and Gowganda and staked many claims with but little result, but was more fortunate in the Shining Tree camp, where his holdings are said to be very valuable. His explorations extended to Ungava, concerning which region he had acquired much information, and he was planning another expedition there when seized with the illness to which he succumbed. Mr. Mullan was 37 years of age and unmarried.

SOCIETIES

Arizona University Society of Mining Engineers—At a recent meeting, Merle Cochran was elected president; Franklin Luis, vice-president; Frank Hobson, secretary. It was voted to issue a monthly journal.

Colorado School of Mines—The 39th annual commencement was held in Simon Guggenheim Hall at Golden, May 23, when degrees were conferred upon 69 graduates. The address was delivered by Dr. James Douglas, of New York, his subject being "Principles more Important than Practice in Technical Education."

American Institute of Mining Engineers—Members of the institute living in and near Denver held a luncheon and meeting at the Albany Hotel, on May 17, for the purpose of organizing a local section. The meeting resulted in a decision to establish a local section covering the state of Colorado. D. W. Brunton was elected chairman of the preliminary organization.

Lehigh University—Dr. Rossiter W. Raymond delivered the annual address to the honorary societies of Phi Beta Kappa and Tau Beta Pi at Lehigh University in Drown Memorial Hall, May 9. Dr. Raymond's subject was "A Critical Episode in the History of the Unity of Italy." Professor Edward H. Williams, Jr., of Woodstock, formerly professor of mining and geology at Lehigh University, gave a series of three lectures, May 8 and 9, for students of Lehigh, on "Glacial Phenomena in Pennsylvania and Adjoining Regions." Professor Williams is the donor of Williams Hall, one of the best equipped and largest of the university buildings.

Massachusetts Institute of Technology—President Richard C. Maclaurin announces the establishment of a course that will be unique in educational institutions, one in industrial physics. This is the outcome of the need for men trained in physics for the solution of problems that present themselves to the industrial world. The new course is the outcome of a real need that has been voiced by President Theodore N. Vail, of the American Telephone & Telegraph Co., who has said that more and more business firms find it to their interests to undertake research in chemistry and physics, the direct relations of which to their specialties are not always obvious. The suggested option differs from those hitherto constituting the course in physics in requiring a less extended study of pure and applied mathematics and a fuller consideration of applied physics both in the lecture room and laboratory. The study of applied optics, heat measurements and electric measurements is greatly extended. Much time is devoted to theoretical and applied chemistry. A very considerable amount of study in mechanical and electrical engineering subjects is required and electro-chemistry, pure and applied, and metallography are likewise included. There is provided an exceptional equipment of instruments and apparatus of precision, so that a large amount of accurate work can be done in the above lines of study.

INDUSTRIAL NEWS

Westinghouse, Church, Kerr & Co. will occupy its new offices at 37 Wall St., New York, commencing May 1, 1913.

After May 1, 1913, Raymond Bros. Impact Pulverizer Co. will occupy its new plant and offices at 1315 to 1325 North Branch St., Chicago.

Ingersoll-Rand Co., 11 Broadway, New York. Form No. 3312. Imperial "XB" duplex power driven air compressors. Illustrated, 20 pages, 6x9 inches.

The Braden Copper Co. is going to put in eight more of the largest size Hardinge pebble mills, making a total of 24 to be used in connection with the flotation process.

The Hardinge Conical Mill Co., 50 Church St., New York, has appointed the Hendrie & Bolthoff Manufacturing & Sup-

ply Co., Denver, Colo., its sales agent in the states of Colorado, New Mexico, South Dakota and Wyoming.

In the April issue of "The Labor Saver," published by Stephens-Adamson Manufacturing Co., Aurora, Ill., are described as completely as possible the general applications of conveying and other machinery manufactured by the company.

The Goulds Manufacturing Co., Seneca Falls, N. Y., in a recently issued booklet sets forth the advantages of electric pumping. Various types of pumps are illustrated and useful data are given by which the cost of electric pumping can be calculated.

The Redwood Manufacturers Co. announces that the engineering department of the pipe and tank departments formerly located at 916 Balboa Bldg. has been removed to 811-812 Kohl Bldg., corner California and Montgomery Sts., San Francisco, Calif.

The Platt Iron Works Co., Dayton, Ohio, reports that while it suffered some damage by reason of the recent flood, its buildings were practically uninjured. The second day after the flood subsided the company had steam up, the service and fire pumps in operation and work on removing mud and débris started. On Apr. 21, all departments were in operation.

Among recent orders received by the Heine Safety Boiler Co., of St. Louis, Mo., is one from the H. J. Heinz Co. for five 607-hp. boilers for installation in its new plant at Pittsburgh. The H. J. Heinz Co. already has 2700 hp. of Heine boilers. The new boilers will be of larger capacity than the old, and will be of the two-drum type with two horizontal passes for the gases.

The Mark Manufacturing Co., Post Office Box G, Chicago, Ill., is placing a novelty in unions upon the market. These are cold-drawn steel, and are consequently seamless, free from sand holes and other structural defects. The Mark union is tapped to Briggs' standard pipe thread. It has the advantage of having the same coefficient of expansion that the pipe has with which it is used, and will remain tight under greater extremes of temperature. The joint is made between a hardened steel ring seated in one of soft brass. Corrosion is guarded against by sherardizing.

TRADE CATALOGS

The Producers Supply Co., Franklin, Penn. Pamphlet describing the Producers' gas engine.

M. Mitshkun Co., Detroit, Mich. Catalog F. Steel rails, mine cars, hoists, etc. Illustrated, 64 pages, 6½x9½ inches.

The Heer Engine Co., Portsmouth, Ohio. Booklet describing the Heer New Traction Engine. Illustrated, 19 pp., 10x7½ inches.

The Garlock Packing Co., Palmyra, N. Y., has issued its 1913 catalog, which contains valuable data concerning fibrous and metal packings.

Mesta Machine Co., Pittsburgh, Penn. A pamphlet describing and illustrating a new type of air valve used on Mesta blowing engines. The advantages claimed are simplicity of air end, no wear, no lubrication required, noiseless operation and reliable and economical operation up to 100 r.p.m.

Chicago Pneumatic Tool Co., Fisher Building, Chicago, Ill. Bulletin No. 137. Giant rock drill, tappet type. Illustrated, 16 pages, 6x9 in. Bulletin No. 138. Giant rock drill mountings. Illustrated, 12 pages, 6x9 in. Bulletin No. 139. Appurtenances for Giant rock drills, including drill steels, blacksmith tools, sand pumps, flexible joints, etc. Illustrated, 16 pages, 6x9 inches.

Hoskins Manufacturing Co., 453-471 Lawton Ave., Detroit, Mich. Bull. No. 3. Illustrated, 48 pages, 6x9 in. In this booklet Hoskins thermo-electric pyrometers are described and illustrated. The device is adapted for the measurement of temperatures between approximately 100° and 1370° C. It gives direct readings of temperatures above the range of thermometers; the temperatures of one or many points may be taken at a central place distant from the source of heat.

The Joseph Dixon Crucible Co., Jersey City, N. J., in a recently published pamphlet "Graphite for the Boiler," states the advantages and methods of using its boiler graphite to keep boiler tubes and shells clean. The action of graphite is not chemical; it simply works into the cracks existing in old hard scale and gradually penetrates between scale and metal making removal easy. Graphite also becomes thoroughly intermixed with new scale as it forms, rendering it soft and crumbly.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

ASPHALTUM—Apparatus for Extracting Bituminous Oil, Oil Compounds, and other Products from Sand Rock and Other Material. Samuel R. Murray and George E. McDermand, Denver, Colo., assignors to the Rocky Mountain Asphalt Mining & Oil Refining Co., Denver, Colo. (U. S. No. 1,060,010; Apr. 29,1913.)

DRILL—Rock Drill. Charles A. Hultquist, Bisbee, Ariz. (U. S. No. 1,059,539; Apr. 22, 1913.)

DRILLS—Chambering Attachment for Rock Drills. John B. Word, Latrobe, Calif., assignor of one-half to William F. Deaner, Amador City, Calif. (U. S. No. 1,051,210; May 6, 1913.)

CONCENTRATION—Apparatus for Concentrating Ore. Peter H. Craven, Spokane, Wash., assignor to P. H. Craven Machinery Co., Spokane, Wash. (U. S. No. 1,060,323; Apr. 29, 1913.)

ORE CONCENTRATOR. William E. Ford, Carthage, Mo. (U. S. No. 1,060,333; Apr. 29, 1913.)

ORE-CONCENTRATOR BELT. Peter H. Craven, Spokane, Wash., assignor to P. H. Craven Machinery Co., Spokane, Wash. (U. S. No. 1,060,536; Apr. 29, 1913.)

ROASTING—Metallurgical Furnace. Utley Wedge, Ardmore, Penn., assignor to the Furnace Patent Co., Philadelphia, Penn. (U. S. No. 1,060,389; Apr. 29, 1913.)

SMELTER SMOKE—Filtering Medium and Process for Making the Same. Frederick Gardner Cottrell, Berkeley, Calif., assignor to International Precipitation Co., Los Angeles, Calif. (U. S. No. 1,060,065; Apr. 29, 1913.)

SULPHIDE ORES—Improvements in the Extraction of Copper from Sulphide Ores and Other Materials. N. V. Hybinette, Kristianssand, S., Norway. (Brit. No. 5806 of 1912.)

BLAST-FURNACE GAS—Improvements in Open-Hearth Furnaces Adapted for Use with Blast-Furnace Gas. Poetter G. m. b. H., Düsseldorf, Germany. (Brit. No. 18,148 of 1912.)

FERRO-ALLOYS—Process of Melting Ferro-Alloys and Keeping them in Liquid State. Wilhelm Schemmann and Jegor Bronn, Rombach, Germany, assignors to Rombacher, Hüttenwerke, Rombach, Germany. (U. S. No. 1,061,016; May 6, 1913.)

BRIQUETTES—Method of Forming Briquettes of Fine Granular Materials for Metallurgical Purposes. W. Boehm, Charlottenburg, Germany. (Brit. No. 8246 of 1912.)

SEPARATION—Process for the Industrial Separation of Lead and Zinc Contained in the State of Sulphides in Ores. Guy de Bechi, Forest Gate, Essex, Eng. (Brit. No. 4246 of 1913.)

ZINC—Method of Obtaining Zinc Oxide and Sinter from Alloys Containing Zinc. Harvey M. Burkey, Newark, N. J., assignor to Metallurgical Company of America, New York, N. Y. (U. S. No. 1,061,447; May 13, 1913.)

SULPHUROUS ORES—Improvements in or Relating to the Treatment of Sulphurous Ores. G. Fusina, Genoa, Italy. (Brit. No. 8426 of 1912.

DRILLS—Improvements Relating to Rock Drills. G. H. Rayner, Sheffield, Eng. (Brit. No. 772 of 1913.)

ELEVATOR BUCKET. Oliver B. Finn, Colorado Springs, Colo. (U. S. No. 1,060,833; May 6, 1913.)

HOISTING BUCKET. Andrew Wirsing, Milwaukee, Wis. (U. S. No. 1,060,730; May 6, 1913.)

MINER'S CANDLESTICK. Frank Pleban, Denver, Colo. (U. S. No. 1,061,948; May 13, 1913.)

COATING METALS—Process for Coating Metal Articles with Copper and Other Minerals. William George Clark, London, England. (U. S. No. 1,061,164; May 6, 1913.)

NITROGEN COMPOUNDS OF SILICON AND ALUMINUM, MANUFACTURE OF. Ottokar Serpek, Paris, France, assignor to Societe Generale des Nitrures, Paris, France. (U. S. No. 1,060,640; May 6, 1913.)

ORE-SMELTING AND REFINING APPARATUS. Edward Fink, Milwaukee, Wis., assignor to Fink Smelters Co., Chicago, Ill. (U. S. No. 1,061,279; May 13, 1913.)

ROASTING—Agitating or Stirring Device for Use in Mechanical Roasting Furnaces. Maurice van Marcke de Lummen, Cologne, Germany. (U. S. No. 1,061,303; May 13, 1913.)

SMELTER SMOKE—Dust and Fume Arrester. John P. Hundrup, Riverside, and William G. Allen, San Francisco, Calif. (U. S. No. 1,061,292; May 13, 1913.)

TEMPERING COPPER, Process for. William H. White, Hazleton, Penn., assignor of one-half to Winifred B. White, Hazleton, Penn., and one-third to Jacob M. Schappert and Margaret Schappert, Dorranceton, Penn. (U. S. No. 1,062,067; May 20, 1913.)

CYANIDING—Separation of Liquids from Crushed Ore Products. William Arthur Caldecott, Johannesburg, Transvaal. (U. S. No. 1,061,660; May 13, 1913.)

CHARGING APPARATUS for Blast Furnaces. Edgar Josiah Windsor-Richards and Thomas Lewis, Glengarnock, Scotland. (U. S. No. 1,061,349; May 13, 1913.)

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Breitung & Co.'s Colombian Enterprises

We have learned that a note in the "Journal" of May 3, stating that a suit involving the title to placer lands has been brought against Breitung & Co., which is operating in Colombia, was incorrect, no such suit having been brought.

EDITORIAL CORRESPONDENCE

SAN FRANCISCO—May 21

Enjoinment of Sierra Nevada Directors from authorizing the payment of the salary of C. E. Julihn, superintendent of the Sierra Nevada mine, at Virginia City, Nev., is sought by Whitman Symmes, who has petitioned the superior court of San Francisco for such an injunction. The purpose is to oust the superintendent from position because of his refusal to allow Symmes to make an examination of the mine. It is claimed by Symmes that he secured a written permit from J. H. Berghauser, president of the company, to make the examination, and that when he entered the mine the foreman prevented him by threats of force from taking samples. The foreman, it was claimed, was acting under orders from Julihn. The board of directors declined to take action on the demand of Symmes; hence his petition to the court.

The Visit of Dr. J. A. Holmes, Director of the U. S. Bureau of Mines, to California during the last week was chiefly for the purpose of organizing the commission selected by the supervisors of Solano County for the settlement of complaints of the farmers against the Selby smeltery; but his purpose was also to visit San Joaquin Valley and Los Angeles and arrange for the appointment of two experts later in the season to examine conditions with a view of preventing waste in gas and the infiltration of water into oil wells, and, furthermore, to prepare for expert investigation of placer-mining conditions, especially along the tributaries to Sacramento River. Doctor Holmes came into California from Seattle and stopped over for a day in Shasta County to visit the Mammoth copper smeltery, the Heroult iron smeltery and the Bully Hill zinc plant, he made a 50-mile auto trip through some of the farms in the so called smoke belt. This visit was due to the recent action of the Shasta County grand jury, which declared the Mammoth smeltery a public nuisance; it was not made at the invitation of Shasta County, but, rather, upon the suggestion of Congressman Raker and particularly because Doctor Holmes desired to see the conditions in Shasta County which it is claimed by the farmers demand stricter regulation of the Mammoth. One day was spent at San Francisco in consultation with Doctor Cottrell and E. B. Braden, manager of the Selby Smelting & Lead Co., and others interested, and for another day a visit to the Selby plant was planned. After the commission is organized and an examination is made of the general conditions, several assistants will be assigned to collect specific data regarding the conditions in Solano County that have required the selection of the commission.

DENVER—May 23

Oil is the Investment of the Hour, here, apparently, and there is great activity among the oil men of Colorado; 30 new claims of 160 acres each were located recently in the Buzzard Creek region 60 miles east of Grand Junction by F. Halderman, R. A. Ross, Frank Smith and others. This makes a total of 64 claims, comprising more than 10,000 acres, which have been located on Buzzard Creek recently. There are two natural gas flows in the new field. The Midwest Oil Co., owned by Denver men, O. H. Shoup, president, earned a net profit of $133,280 in April from the wells in Wyoming, where the company is erecting a second refinery at Casper. The profits for this year, it is stated, will aggregate more than $1,000,000. Net profits for the first four months of this year amounted to $463,427; the company is capitalized at $6,000,000. At Debeque, near Glenwood Springs, a flow of oil was struck at 1440 ft. by the Grand River Gas & Oil Co.

Bonds for the Moffat Tunnel project will now probably be issued as the vote polled May 20 was overwhelmingly in favor of amendment of the charter, to permit the city of Denver to make this issue. This will mean employing thousands of men in engineering work, opening up new coal fields, placing Denver on a transcontinental line, and will give new life and energy to a community, which of late has been dejected, not to say moribund. The Burlington R.R. permit to enter Denver was also carried, as well as the Colfax-Larimer street viaduct bonds for $250,000. The voting on the bonds of the Moffat tunnel will come later, but before it is referred to the people the Denver & Salt Lake R.R. will put up $1,500,000 as a first payment on account of the tunnel construction. It is probable, however, that Newman Erb will commence the approaches to the tunnel at once, as the amendment was carried by such an overwhelming majority that there is little doubt that the bonds will be voted later, and this having been done, the railway company will have no trouble in financing the rest of the road from Craig to Salt Lake City, which will cost upward of $15,000,000. The tunnel will be owned outright by the city and county of Denver until such a time as the Denver & Salt Lake R.R. pays the entire amount of the bonds. The city retains perpetual right to carry water and power through the tunnel. All railroads coming into Denver from the east or west may use the tunnel on a fair and equitable basis. A feature important to the railroad from an operating standpoint is that the maximum grade between Denver and Salt Lake City will be reduced to 2%. This means a saving in operating expenses to the road of $240,000 per year. This amount is sufficient to take care of the interest on the bonds, or to create a sinking fund sufficient to redeem them. According to the agreement between the city and the railroad, but $3,000,000 worth of bonds are to be issued by the city of Denver and these bonds are to cover a period of from 40 to 50 years and draw interest at 4%. The tunnel commission consists of three members who were named in the amendment submitted to the people and who are by the adoption of the amendment elected members of the commission. They are Hon. J. C. Helm, Charles MacAllister Willcox and Jesse E. Fleming. The commission's work is the arrangement of a plan for a bond issue by the city to cover approximately one-third of the expense of the construction of the tunnel, the plan and proposed issue to be submitted to the people for approval or rejection.

SALT LAKE CITY—May 22

Suit by the Utah Copper Co., to recover an excess of taxes levied by the board of equalization and collected by the county treasurer, has been decided in the U. S. district court by Judge John A. Marshall. Judge Marshall instructed the jury to find for the mining company, the amount decreed to be returned, amounting to $29,444. The point at issue was the allowance of expenditures in the development of mining properties and the providing of facilities for the handling and reducing of the ores. The company held that these expenditures were properly to be deducted from the gross revenue, before the net profits could be established. The findings of the state board of equalization, as applied to the mining industry, have often been questioned.

BUTTE—May 21

A Northern Pacific Extension from Bridger, the present terminal, into the coal-mining district in Carbon County in the southern part of the state, and on to Bear Creek, has been the subject of many rumors. The report was recently verified when the railroad ordered from an abstract company of Red Lodge, a total of 59 abstracts of title to land through which the proposed right-of-way will pass. The abstracts as soon as completed are to be forwarded to Gunn & Rasch, of Helena, counsel for the Northern Pacific. Mayor Leavens, of Billings, who is identified with coal-mining operations in Red Lodge, was instrumental in obtaining the titles for the land from individual owners.

Power-Plant Construction Has Been Started on Clark Fork of Columbia River, at Thompson Falls, in the western part of the state. The work will be done by the Thompson Falls Power Co., a subsidiary of the Montana Power Co. Stockholders in the power company, and representatives of the Anaconda Copper Mining Co., arrived at Thompson Falls, May 16, to make preparations for the beginning of work. Those in the party were Max Hebgen, manager of the Montana Power Co., State Senator Edward Donlan; Carl E. Pickett and H. T. Harmon, of Boston; R. G. Child, of Chicago, and Kenneth Ross and John R. Toole, of Missoula, officers of the timber department of the Anaconda company. Two crews of men are operating drills along the river bank to determine the condition of the underlying strata for a dam site. Forty men are employed in grading spur lines from the main line to the dam, and power-plant sites, and a force of 25 carpenters will arrive soon to erect buildings to house the force. As the work progresses the force now employed will be gradually increased, until by August, during low water, it is estimated that 600 men will be on the pay roll. The work will be carried on with all possible speed, and will require about three years for its completion. The principal use for the electric

power generated at this plant will be for the operation of trains on the Chicago, Milwaukee & St. Paul Ry. in the western part of Montana, the electrification of this road for a distance of several hundred miles in the mountain region of Montana, being an assured event of the near future.

NEGAUNEE—May 22

The Dockage Charge of 5c. per ton being levied this year by iron-ore-carrying railroads is objected to by the mining companies, especially by the small producers, which own no ore boats or docks and can only forward shipments from mines rather slowly on account of limited production. The charge was not made in previous years, but the railroads claim that abuses have occurred because mining companies have held ore in cars and in docks for weeks awaiting the arrival of vessels, thus tying up hundreds of ore cars. The 5c. per ton is the minimum dockage charge and is for ore shipped from the docks within 10 days after having been received in the yards; when not loaded into vessels within that time an additional charge of ¼c. per ton per day is made. The Newport Mining Co., owned by Ferdinand Schlesinger, of Milwaukee, has filed formal complaint against the charge before the Interstate Commerce Commission. The mining companies are accustomed to dump all ore hoisted during the shipping season directly into railroad cars at the shafts and the railroad companies haul the cars away at least once per day. If the mine is a small one it may have a boat scheduled only about once a month, and previous to its arrival, the company puts a steam shovel at work on its winter stockpile to help hurry a boatload of ore to the dock. The smaller companies claim that to avoid excessive overcharges on ore stored at the docks they will have to put the daily hoists of ore on stockpile at the mines and then handle it again when a boat is due, making an additional cost of about 10c. per ton, which is a charge of moment on a low-priced material, such as iron ore. The larger companies are not so much bothered by the 10-day limit, although some of those having their ore divided into different grades, which are sold and shipped separately, are affected. The Minnesota mines of the Oliver Iron Mining Co., shipping over the Duluth, Missabe & Northern Ry. and over the Duluth & Iron Range R.R., are not concerned, as these railroads are controlled by the Steel Corporation, of which the Oliver company is a subsidiary. The Marquette range mines of the Cleveland-Cliffs Iron Co. are also not concerned, as this company owns its own railroad, the Lake Superior & Ishpeming.

DULUTH—May 24

The Great Movement of Iron Ore that is assured for the Lake Superior iron region for this season is now well started, but the boats are still experiencing some interference and delay from the ice. A northeast wind drives the ice in at the head of the lakes and a westerly or northwesterly wind does the same at the eastern end of Lake Superior. As a rule, however, the boats are making good time. The banner months in the ore-shipping season are July and August. The Mesabi range in 1912 shipped 32,000,000 gross tons, and that amount will, it is expected, be exceeded this year. The Vermillion range, which last year shipped 1,850,000 gross tons, will this year probably ship more than 2,000,000. A shortage of miners has been complained of throughout the Lake Superior region for the last year. The Vermillion range will this year have a new shipper, the Vermillion Consolidated, of which Thomas J. Walsh, of Duluth, is president. The mine is on the north side of Lake Vermillion, in what is locally known as the Mud Creek district. New shipping mines on the Vermillion are infrequent, and, therefore, of corresponding interest. The Duluth & Iron Range R.R. has surveyed and grade-staked a branch line to the Vermillion shaft of the Consolidated, which company will make a moderate shipment this season, and will be in position next year to deliver a substantial tonnage.

The Oliver Iron Mining Co. properties at Ely, on the Vermillion range, stockpiled more heavily last winter than during the winter before, and when the work of putting ore in stock began last autumn the last ton of the stockpiles of the preceding winter had disappeared. The large stockpiles this spring at Ely represented the winter work, and no part of them consisted of ore carried over. The Sec. 30 Mining Co., one of the comparatively new independent iron-mining companies on the Vermillion range, which last year shipped 157,344 gross tons, will this season forward at least 250,000 tons. The corporation mines at Ely, which are the Pioneer, Zenith, Savoy and Sibley, and all large properties, are operating heavily and each has an imposing stockpile. The old Chandler is still in the running. It was supposed to have been worked out several years ago, but it continues to deliver a fair tonnage of the ore which made the mine and the range famous years ago. The property of the White Iron Lake company, near Ely, will, one of these days, become a shipper. Diamond drills have located the orebody, and a shaft has been sunk on the ore for a short distance. It will take several years to make a shipper of importance of the White Iron mine, and this suggests that according to reports in mining circles there is a bid for the property from one of the large independent ore-consuming interests. The North American mine, at Tower, which is but one-half mile from the Soudan mine, which was the first shipper in Minnesota, gives promise of soon yielding ore from the drift on the 400 level. The drift, which is 220 ft. from the shaft, is breasted in "paint" rock and soapstone, which kind of ground is considered significant of the proximity of iron ore. Speaking of the Soudan mine, and the persistence of Vermillion-range ore deposits, it was but a few years ago that it was announced in mining circles that the property was nearly worked out, yet the Soudan mine has today more ore in sight than it has shipped since it became a shipper in the early '80s. The Cuyuna range will, it is estimated, ship 1,000,000 gross tons this year, as against 305,114 tons in 1912 and 147,431 tons in 1911.

SPOKANE—May 23

Negotiations for a Loan are pending between officers of the Idaho-Continental Mining Co. and representatives of John D. Ryan, president of the Amalgamated Copper Co. An additional loan of $125,000 is required to complete the wagon road from Porthill, Idaho, to the mine, 26 miles, and to complete the concentrator and compressor plant, as well as to finance further development of the property. A meeting of the stockholders has been called for June 7, in the offices of President Klockmann, in Spokane, to consummate the deal. Mr. Ryan, through the International Smelting & Refining Co., several months ago advanced the Idaho-Continental $125,000 to finance improvements, the engineers in charge of the work having estimated that it would require that amount to complete the work. Later it was discovered that the original estimate was low, and a further loan of $75,000 was negotiated, but this also proved insufficient, and it is now proposed to borrow $125,000 more. If the third loan is made the Idaho-Continental company will be indebted to the International company for $325,000. Conditional to the further advance the International company imposes, that it shall be permitted to name three members of the directorate, that a voting trust be created to carry out this agreement, that it shall name the manager of the company until the money advanced has been repaid, and that it shall have an option on 150,000 shares of the Idaho-Continental company at 50c. per share, to be taken and paid for within 60 days after the $325,000 indebtedness has been fully paid. The call for the special stockholders' meeting states that the International company has shown absolute confidence in the ability of the company to liquidate its obligations, not only by consenting to make a further loan, but by agreeing to extend the time of payment of the $200,000 already advanced until June, 1917, with interest at 6% per annum. The $125,000 is to be repaid before June, 1918, and is to bear interest at the same rate.

COBALT—May 23

Agitators, Professional and Socialistic, have been endeavoring to bring about a strike of the miners for some time. After two unsuccessful attempts, they have at last been able to get a majority to say that a ballot should be taken May 25, to decide the question of whether or not a strike should be called. The principal argument is that when the eight-hour law comes into force next January, the mine managers intend to cut wages, and as it would be inadvisable to call a strike in the winter, they wish to call it now while the camp is booming and labor conditions are good. There is, of course, little to be said in favor of this contention. While the mine managers advanced this an an argument against the passage of the eight-hour law, they have all practically stated that since the law passed the legislature, no attempt will be made to cut wages.

ATLIN, B. C.—May 14

Silver Creek in the Teslin District, from which region reports of rich placer discoveries have been coming for several months, does not seem to be all that was first claimed for it. Men who have returned after prospecting for a time, although they struck no pay, do not altogether condemn the country. A large number of miners are staying in to prospect when the ground thaws and if there is pay there it ought to be found. The country is staked for miles around the alleged pay location. In certain parts of the Northwest it was lately reported that the news of finding gold in the region of Teslin Lake was circulated by the Indians who expected to make good wages in supplying the prospectors whom they hoped to stampede into the country, but this story may have come from a disappointed prospector.

THE MINING NEWS

ALASKA

Circle District

HYDRAULIC OPERATIONS on a larger scale than during 1912 are being prepared for. Many plants are now ready for the run of water.

ARIZONA

Cochise County

COMMONWEALTH—The new mill building, at Pearce, is proceeding rapidly, the framework being in place.

Gila County

WHITE METALS DEVELOPMENT CO.—This company has suspended operations at its mines north of Globe, for at least a time. The company's property included the old McMorris mine, in Richmond Basin, which was a well known producer of silver ore until as late as 1882. In June, 1912, W. D. Fiske, of Globe, and associates, installed a new gasoline hoist and part of the 800-ft. shaft was retimbered. In September, 1912, the 200-ft. level was cleaned out and considerable work was done. From the fact that there is evidence of much silver ore in the property the present cessation of work is probably only temporary.

MIAMI COPPER CO.—Interesting experiments are being made in one of the sections of mill unit No. 6. A double-deck sand table was recently installed and has proved satisfactory. It is one of the Deisters' latest inventions, owned by the Deister Machine Co. In an endurance test of 60 days the table has met all expectations, both in regard to performance and structure. A Deister baffle-cone classifier was also installed on the sand floor, and it has given good results. It is simple in construction and is easily operated. On the slime floor all the pulp formerly treated on No. 3 slime tables is now treated on four Deister multiple-deck tilting slimers. These machines have been in operation for some time and are making a high recovery. By using the multiple-deck slimers and retreating the middlings from the sand floor about 2 lb. more of copper is being recovered per ton of ore treated than in the other sections of the mill.

INSPIRATION—At the incline or main supply shaft, the hoist compartment has been completed for present requirements to a depth of 620 ft., although it will be sunk in the future to a depth of 860 ft., measured on the incline. Work on two other compartments has been begun from the main tunnel. Waste from the preliminary work beneath the Colorado orebody is now being taken from the mine through the incline shaft, but when the ore is encountered it will be hoisted through the Scorpion shaft and placed on a dump, or stockpile, until the mill is ready for ore. The main drift on the upper tram level lacks 580 ft. of completion. On the sixth level drifting is in progress to connect the Scorpion shaft with the drift that connects with the main east and west shafts; a drainage drift is being driven on the same level. At Live Oak No. 1 shaft, waste is being lifted to the 200-ft. level and dropped back to the pocket on the Sulphide tunnel whence it is being taken to the surface to build a yard for the railroad spur which will be level with the dump. The rails will probably be laid on the dump in about four or six weeks. The long crosscut between shafts No. 1 and No. 2 at the Live Oak has been completed; it is 2200 ft. long. At the main east and west shafts, surface work is progressing rapidly, excavation for the crusher and railroad building being nearly completed. The ore will be crushed to 1 in., and then be conveyed to a 25,000-ton bin along the railroad, whence it will be hauled by rail to the mill. The orebin will be 250 ft. long.

Graham County

REYMERT—The Gunn, Thompson syndicate, recently secured a bond and option on this group, agreeing to do much development work. Extensive bodies of lead-silver ore are already developed and blocked above the copper zone.

Maricopa County

ARIZONA PROSPECTING & DEVELOPMENT CO.—The copper mine, near Wickenburg, owned by this company, is not being worked at present, as changes in the scheme of development are being considered; it is thought that work will be resumed in a month or two.

Mohave County

KINGMAN COPPER CO.—It is reported that this company will continue the prospecting of the copper claims in Mineral Park, at greater depth and that it has brought in two new drills for that purpose. The old drill has proved considerable ore at light depths.

Pima County

ARIZONA BELMONT—A geological examination of this mine, near Silverbell, was completed in April by Frank H. Probert. He will return to the property to determine the method to be used for concentrating the lead and silver ore. The date for beginning construction work on the mill has not been decided.

Pinal County

KELVIN-SULTANA—Extensive tests have been made on the new power-house equipment, recently installed, and the electric hoist has been placed in commission.

LONDON-ARIZONA—The company has 15 carloads of ore waiting to be shipped. Mining is continued uninterruptedly, but shipments have been held up pending the settlement of the strike at the El Paso smeltery.

DAILEY ARIZONA COPPER CO.—Thirteen copper claims, at Apache camp, owned by Dailey Bros., have been deeded to this company. The claims lie between two properties recently purchased by the Copper Queen company, in the Old Hat district.

Santa Cruz County

COPPER QUEEN—This company, which has been working a group of claims in the Harshaw district, owned by Sheehy Bros., has discontinued the work and left the property, being unable to secure an extension of time.

Yavapai County

AMERICAN BONANZA—After several months of idleness, development has been resumed in the main shaft and drifts from it.

CLIMAX—Pending the arrival of two Wilfley tables, the mill is being operated steadily on the ores from the large low-grade vein. If the mill test shows a margin of profit the mill will be much enlarged.

DIVIDEND—The holdings of this company, in the Chaparal district, have been sold by the Commercial Trust & Savings Bank, of Prescott, for $86,814, the amount of the judgment against it. Charles Grimes, of Pasadena, Calif., was the purchaser and will reopen the property soon.

CALIFORNIA

Amador County

RUMORS OF A MINERS' STRIKE in the mines, at Amador City has been declared unauthorized by the secretary of the miners' union, which is affiliated with the Western Federation of Miners. The recent influx of Spaniards and Mexicans who are employed underground, and the failure of passage of certain legislation in the recent session of the legislature, are supposed to have caused the rumor.

BUNKER HILL—A new electric pump has been installed. The inclined shaft will be deepened for two stations below the 1950-ft. level.

DEFENDER—A 2-drill compressor has been installed, and a new model Lane mill will be installed for regrinding. The mine, which is under bond to J. H. G. Wolf, of San Francisco, is equipped with a 5-stamp mill, and was formerly a producer.

VOORHEES—The old chlorination dump of this mine, at Drytown, will be worked over and be treated by the cyanide process. Benjamin Hall, of Nevada City, has purchased the dump and will build a cyanide plant. The tailing accumulated during several years of active operation of the mine before the railroad was extended from Ione to Jackson, when milling and chlorination was more economical than shipping to Selby, owing to the long wagon haul.

Calaveras County

LIGHTNER—This property, at Angels, will be reopened by the Lightner Mining Co., the original owner. An assessment of 5c. per share has been ordered by the directors. The delinquent taxes have been paid. The mine has been examined and sufficient ore is reported in sight to warrant starting 40 of the 60 stamps.

Inyo County

BLUE BELL—This mine, near Darwin, is equipped with a 5-stamp mill and cyanide plant, and has been in operation for the last 20 years.

CUSTER—A 40-hp. Olds hoist is to be installed to replace the Weber 10-hp. hoist. The ore is high grade, and silver is the chief valuable constituent. The shaft is 350 ft. deep and sinking and drifting are in progress.

WILSHIRE BISHOP CREEK—Ten stamps are now dropping on dump ore. During the recent period of idleness, the 300-ft. shaft filled with water to the 50-ft. point from the collar. The shaft is being unwatered with a Gould pump. Extraction of ore will be resumed when the water is out.

PANAMINT—The Blue Flag Mining Co. has taken over all the property of the Panamint Consolidated Mines Co., situated in the Panamint range, near Ballarat, which includes 17 claims, embracing about 240 acres. High-grade gold and copper ore is reported to have been disclosed by development. The Blue Flag company operates in Colorado and Arizona also.

Kern County

RED DOG MILL—A 35-hp. electric motor has been received for installation at this custom reduction plant, at Johannesburg. The mill has been operated by steam.

YELLOW ASTER—A dividend of $5000 was declared Apr. 28. This makes the total dividends to date $1,156,789. The new air compressor has been installed at Old Wells pumping station and connected to the Obear air-lift pump. Test runs have proved satisfactory. The plant lifts 3600 gal. of water per hour and provides ample supply for the stamp mills.

Mariposa County

ORIGINAL MINING & MILLING CO.—A dividend, amounting to 40%, has been declared; and is the first dividend paid by the company. The mine is near El Portal.

Nevada County

VICTOR GATES VS. NUMITOR MINING CO.—This case is on trial, the plaintiff suing for $47,500 for loss of leg, which was caught in the mill machinery.

GASTON—The mine and mill have been closed down, whether temporarily or permanently has not been stated. It had been reported that the mill was crushing pay ore at the time of closing.

IDAHO-MARYLAND—Two men were killed in this Grass Valley mine, May 8, by the falling of a large rock in a drift on the 1000-ft. level. The men were timbermen, and were measuring the ground for timbering, and cutting hitches for the stulls. It is supposed the digging loosened the ground. The work was being directed by the mine foremen, who escaped with a bruised hand.

PENNSYLVANIA—The third payment on the purchase price is said to have been made by A. H. Winn, of San Francisco, representing the owners of the Empire mine, who are operating the Pennsylvania under purchase bond. This payment, which was made to F. J. Thomas, secretary of the Pennsylvania company, is $60,000, making a total of $140,000 paid on the purchase price said to be $500,000. The mine is operated under the supervision of George W. Starr, superintendent of the Empire.

Placer County

DEWEY—This mine, at Forest Hill, is producing high-grade ore, which is shipped by wagon to the Malmberg mill, at Auburn.

WALDO-ADAMS—A new mill and crusher were recently installed and are now in operation at this mine, near Bowman, in the Ophir district.

Plumas County

CAMERON—This placer mine, on the north fork of Feather River, near Rich Gulch, has been bonded to Dr. J. P. George, A. K. Wheeler and Sol. Camp, of Nevada. The 500-ft. tunnel will be advanced and raises are to be made to the gravel. There is also an 800-ft. tunnel on the outside rim, from which pay gravel has been mined. It is believed the lower tunnel will develop the main channel. The mine is situated in the lava-capped section of the high mountains.

Sacramento County

NATOMA NO. 7 DREDGE—This 9-cu.ft. bucket-elevator all-steel dredge began digging in Blue Ravine, four miles west of Folsom, May 12. The boat is equipped with 98 buckets. The digging ladder is 122 ft. long; the stacker 155 ft. 7 in. long. The initial performance of this boat proved it to be one of the best constructed dredges in California. Much of the machinery of old No. 7, which was formerly Folsom No. 3, was used in the new construction.

Santa Barbara County

CARPINTERIA ASPHALT MINE is reported to be producing 35 tons per day. This is one of the largest asphalt mines in the state and has produced more than 100 tons per day.

Shasta County

THE MINING CONGRESS, of northern California and southern Oregon, opened at Redding, May 20. The California delegates are chiefly from Shasta, Siskiyou and Trinity Counties. The program arranged for a visit, May 22, to the Mammoth copper smeltery, and the Heroult iron smeltery.

DONKEY AND BAKER—These two mines, near Ingot, have been bonded to Nevada and Utah men, said to represent the U. S. Smelting, Refining & Mining Co., and the Western Ore Purchasing Co. The owners of the mines are represented by Fred Grotefend, of Redding. The Donkey is an old mine which has been developed by a 200-ft. shaft and drifts. It was developed for copper several years ago, but the presence of zinc made the ore undesirable in the period when zinc smelting had not been attempted in Shasta County. The Baker is a silver-zinc mine.

Trinity County

THE GUGGENHEIM EXPLORATION CO. has relinquished the purchase option on the Alta Bert dredge and dredging ground, notwithstanding the large yield of the gravel dredged. It is understood the showing made by the Keystone drills on the gold-bearing placer grounds was not sufficient to induce the company to make the purchase of the entire holding. These placer lands are on Trinity River between Lewiston and Carrville.

COLORADO

Clear Creek County

COFFIN—The development of this property, in the Daly district, will soon be resumed.

REFUGEE—This mine, together with part of the Shafter property, on Bellevue Mountain, will be reopened and developed through the Central tunnel.

MINERAL CHIEF—Development will be resumed in about 30 days. The sixth level will be reopened and the lead-zinc ore exposed in this level will be prospected.

DONALDSON—The rich oreshoot recently opened in this property has been developed for a distance of 50 ft. The ore maintains its width and grade. Stoping operations have been started.

TENNESSEE TUNNEL—Work has been suspended in the breast of the crosscut tunnel and drifting has been started on the vein, supposed to be the King Solomon vein, intersected 900 ft. from the portal.

ANAMOSA—This Columbia Mountain property has been secured by the Anamosa Mining Co. Active production will be resumed about June 1. The company intends to ship its ore to the custom mills at Idaho Springs.

TOLLAND COUNTY—A contract has been let for additional development in this Ute Creek property. A drift will be driven on the vein recently cut by the crosscut tunnel. The vein is 3 ft. wide and assays $10 per ton in gold and silver.

OHIO—This property, together with the Simpson and Sweepstakes mines, on Leavenworth Mountain, has been purchased by J. R. Campbell and associates. The 400-ft. adit on the Ohio vein will be cleaned out and advanced, and crosscuts will be driven to intersect the other veins.

DOCTOR—An adit has been driven on the vein a distance of 400 ft. A 5-ft. vein of quartz ore assaying $30 per ton in gold and silver, has been opened for a distance of 200 ft. The property is owned by the Argo Mining & Milling Co. A fund has been provided for active development.

GOLDEN EDGE—This property, which adjoins the Garden and Sun & Moon mines, on Seaton Mountain, will be operated through the Newhouse tunnel. An 8-ft. vein has been developed in which there is an 18-in. streak of $10 ore on the foot wall and a 2-ft. streak of $20 ore on the hanging wall.

ACCORD—This company, owning extensive property on Saxon Mountain, has made financial arrangements for an extensive campaign of development. The main crosscut, known as the Culley tunnel, is about 900 ft. long and cuts three promising veins upon which drifting will be continued. On one of these veins an oreshoot has been opened for a distance of 200 ft. The pay ore is 2 ft. wide and assays $12 per ton. The company contemplates advancing the Culley tunnel to intersect the extensions of the Anamosa, Millington, American Sisters and Joe Reynolds veins.

LITTLE GIANT—This company has secured control of the Commodore and Tabor tunnels and other properties on Red Elephant Mountain, and plans extensive development. The company now owns 60 patented lode claims and three millsites along Clear Creek. The White vein, which is regarded as the main vein of Red Elephant Mountain, is controlled for a distance of about one mile. The portal of the Commodore tunnel is on the line of the Colorado & Southern Ry. It is 3000 ft. long and cuts the veins at a depth of about 800 ft. The portal of the Tabor tunnel is about 150 ft. higher than the Commodore tunnel. It is the intention to extend both of these tunnels and ultimately make a connection with the Little Giant shaft. The Tabor tunnel will have to be advanced about 800 ft. to reach the vein. The company contemplates remodeling the power-house building and converting it into a mill. It is estimated that a substantial quantity of $15 ore is available for concentration.

Conejos County

THE GOLDEN CYCLE COMPANY, of Cripple Creek, it is said, has options on most of the big mining claims of Platoro camp, and will build a mill there.

Lake County——Leadville

YAK TUNNEL—An oreshoot has been struck in the Vega ground, in a drift from the winze, near the breast of the tunnel, but no details are at hand yet.

STONE SHAFT—The lessees in this mine were forced to stop production of low-grade zinc-carbonate ore, but have increased shipments of silver-lead.

HILLTOP—The bins at this mine, in Horseshoe district, are filled with ore, which cannot be shipped, owing to the failure of the railroad company to furnish cars.

FANNY RAWLINGS—The lessees on this mine, in Gold Basin, have built a 700-ft. tram from the shaft to the railway, and now deliver the ore direct to the cars. The first carload has just been sent over it to the smeltery. The ore contains both silver and gold.

Teller County—Cripple Creek

ACACIA—This mine has resumed operations at the South Burns shaft, and the mine will be leased in blocks, the North Burns shaft which has been closed down for repairs will also be started up in a few days.

PORTLAND—The No. 2 shaft has reached water level in this mine, 83 ft. below the 1500-ft. level, and sinking has been suspended. The water is still receding at the rate of about 8 ft. per month. The oreshoots in the deep levels are large and sinking will be continued to the 1800 if they hold out, and as soon as recession of the water permits.

San Juan Region

JOE & JOHN—This mine, owned by the Allerton company, in Prospect basin, on the east side of Red Mountain, is said to have a large shoot of pay ore. It was struck, Mar. 15, in the lower tunnel, which was driven 1758 ft., and where the vein was intersected the ore is from 6 to 10 ft. wide. It is sulphide ore, containing silver and gold, with a little copper.

IDAHO

Coeur d'Alenes District

IMPERIAL—A diamond drill will be used to explore this property.

GUELPH—As soon as the snow is gone, six men will be put to work to drive the tunnel 100 ft. to the vein, at this property, at Burke. There is some rich ore in the upper workings.

VULCAN—Ore was struck at this property in the long crosscut tunnel, the showing consisting of several stringers of lead ore, which are now being followed by drifting, 1400 ft. below the outcrop.

DULUTH—A crew of men is to be put to work at this property, near the Standard and the Hecla mines, at Burke. There is a good surface showing and a crosscut tunnel has been driven in 200 ft., which will now be driven 600 ft. to cut the vein at a depth of about 600 feet.

MICHIGAN

Copper

KEWEENAW COPPER CO.—Drill hole No. 43 has encountered the Ashbed lode, at a depth of about 200 ft., and the formation, as shown in the drill core, is of uniform character and well mineralized.

MOHAWK—The permanent equipment at the new No. 6 shaft will soon be ready to be put in commission and when this is accomplished this shaft will produce a large percentage of the total mine output. At No. 3 shaft one shift of men has been discontinued, and when No. 6 is in active service, work at this shaft is to be abandoned.

SUPERIOR COPPER CO.—No. 1 shaft at this property is down to the 20th level, and a station is being cut preparatory to drifting. Openings at this shaft continue to be satis-

factory, with most of the ore going to the mill being mined from the West lode. No material increase has been made in the amount of ore going to the mill since the change from the Old Atlantic mill to the Lake Milling, Smelting & Refining Co. plant. At No. 2 shaft, sinking continues and is below the 14th level in an unsettled formation and will be sunk to the 17th level, where the two shafts will be connected. The hoisting equipment that was used at No. 1 shaft is being erected at this shaft and will meet all development requirements.

Iron

JAMES—A new Bucyrus steam shovel has been purchased for this mine of the Mineral Mining Co.

VERONA MINING CO.—This company is erecting a new brick machine shop at its mines, at Palatka.

PURCELL—Drifting on the first level has been started at this new shaft of the McGreevy Steel Co. The mining of this ore will be carried on as quickly as possible; the deposit not being large.

VOLUNTEER—This mine, at Palmer, in the Cascade district, is preparing to ship its large, high-grade stockpile, which has been accumulating for two years. A new steam shovel has been purchased.

BRULE MINING CO.—This subsidiary of Oglebay, Norton & Co., in the Iron River district, has torn down the old headframe at the Chatham mine, and erected a new one. Twelve new houes are being built at the Lenox mine, and six at the Berkshire. At Commonwealth, Wis., Oglebay, Norton & Co. is erecting six new houses.

GREAT WESTERN—A steam shovel was recently put to work in the stockpile at this mine of Corrigan, McKinney & Co., in the Crystal Falls district, and a sample shipment of 2000 tons was made to a purchaser. This stockpile has stood at the mine for three years, and the mine has been closed down, because of the high sulphur content of the ore, which runs up to nearly 3%. Purchasers could not be found for ore containing so much sulphur, although Corrigan, McKinney & Co. claims the ore to be usable in basic furnaces, and is erecting several new furnaces of that kind, which will use Great Western ore.

ATHENS MINING CO.—This company, controlled by the Cleveland-Cliffs Iron Co., will soon start sinking a hoisting shaft and equipping a mine on its land in the Negaunee basin. A steel shaft-house and brick buildings will be erected. Mine machinery will be electrically operated. This land like that at the Lucky Star mine nearby remained idle for years due to litigation between the Cleveland-Cliffs Iron Co. and the Breitung-Kaufman interests. A year ago a compromise was affected by which the Breitung-Kaufman interests are developing the Lucky Star, and the Cleveland-Cliffs company will operate the Athens property. The ore lies deep but diamond drilling has indicated a large body.

MONTANA

Butte District

RAINBOW—Operations at the property, east of the Butte & Superior company's holdings, include sinking the shaft to the 800-ft. level; the work has already carried the shaft a short distance below the 400-ft. level. As soon as this work is completed, crosscuts will be driven on several levels to open the veins which outcrop on the surface. It is believed that the vein in the Butte & Superior ground traverses a portion of the Rainbow company's territory. Electric pumps have been installed.

DAVIS-DALY—The vein opened some time ago on the 1400-ft. level of the Hesperus claim, is surpassing all expectations as progress is made in its development. Drifting has been done for more than 100 ft. on this vein, the ore being of good grade, carrying copper and silver, and being from 8 to 17 ft. wide. Charles G. Schirmer, of Boston, secretary of the company, recently spent three days in Butte, making inspections of the property. The company is shipping more than 100 tons of ore daily.

ALEX SCOTT—A depth of 1900 ft. has been attained in sinking the shaft, the rate of sinking having averaged nearly 100 ft. per month for some time past. It is expected that the objective point, the 2200-ft. level, will be reached by August, when a station will be cut and crosscutting to the vein will be started on that level. Fine ore was opened in the mine some time ago by a drift driven from the lower levels of the West Colusa mine, and the company is sinking the shaft with all speed in order to open and begin hoisting this ore through its own workings.

BOSTON & CORBIN—A protective committee has been formed to formulate plans for a reorganization of this company as a result of technicalities which made it impossible to float the proposed issue of $150,000 convertible bonds at a fair price to the company. The company has a net indebtedness of about $40,000, after allowing for a credit of $15,000 which is outstanding for concentrates shipped, but not settled for. The exact amount of money which will have to be raised is not definitely known, but it is thought that the new company should start out with at least $100,000 working capital. This would, therefore, involve the raising of, say, $150,000, which would mean an assessment of $1.50 per share on the present outstanding stock. The reorganization will probably involve the elimination of N. L. Amster as president of the company. Up to the present in addition to the original cost of the property about $700,000 has been spent.

East Coeur d'Alene District

IRON MOUNTAIN—A Macquisten-tube plant is to be installed here to recover zinc which has heretofore been lost.

IRON MASK—The 400-ft. raise from the 800-ft. level has been completed and the oreshoots above this level can now be explored.

LITTLE PITTSBURGH—This property will be opened and extensively developed. The property has several good showings, but little work has been done on it.

KING & QUEEN—The crew of 40 men at this property will be doubled, to meet the increased capacity of the concentrator. The addition of new crushing machinery has doubled the milling capacity.

Fergus County

BARNES-KING—During April this company, which is operating the North Moccasin property at Kendall, mined and milled 3048 tons of ore, from which $24,873, or $8.15 per ton was recovered. Operations were suspended for several days while repairs were being made by the Kendall Power Co. The sum of $10,655 was paid on the amount due the former owners of the property, leaving a balance due of $85,543.

Jefferson County

BUTTE & CORBIN—A meeting of the stockholders is to be held soon to arrange for the resumption of work on the property in the Corbin district. There are six patented claims in the group, in which a tunnel is now 600 ft. in with a winze down 60 ft. and it is estimated that ore has been blocked out, worth several thousand dollars.

NEVADA

Humboldt County

APRIL OUTPUT OF ROCHESTER is estimated at 420 tons of ore, averaging $35 per ton.

COLLIGAN LEASE—On this lease, operated by the Rochester-Nugget Mining Co., an aërial tramway will be built.

LIMERICK—Excavation has begun on the millsite. This mill will treat ores from the Limerick, Plainview and Plainsite mines.

CODD LEASE—This lease is now shipping 45 tons daily, averaging about $45. This production will be doubled in the near future.

Lyon County

ROSSLAND—This group, 20 miles east of Mason, is now shipping copper ore to the Thompson smeltery. The group is being worked by lessees, and is owned by Ross Thompson, the discoverer of Rossland, British Columbia.

UTAH-YERINGTON MINING CO.—On this group, operated by Wood & Bugbee, lessees, work has been resumed, and a car of good-grade copper ore is ready for shipment. The ore carries some lead and silver. This is probably the first lead found in the Mason district.

NEVADA COPPER BELT R.R.—The traffic department announced that it has secured the freight haul of the mine and mill equipment of the Knight Investment Co., of Aurora, Mineral County, Nev. The nearest railroad point is Hudson. The contract is for hauling 2000 tons of machinery and supplies.

MASON VALLEY MINES CO.—Ore receipts at the smeltery, at Thompson, for the week ended May 15, 1913, were as follows: From Mason Valley mine, 2614 tons; from Nevada-Douglas, 1476; from other mines, 1349; total, 5439. Daily average, 777 tons. In the same week seven cars of matte were shipped.

Nye County

SHIPMENTS in tons from Tonopah mines for the week ended May 17 were as follows:

Tonopah Mining	3,300	North Star	200
Tonopah Belmont	3,505	Mizpah Extension	....
Montana-Tonopah	1,007	Jim Butler	400
Tonopah Extension	1,060	Tonopah Merger	220
West End	1,055		
Midway	50	Total	11,332
MacNamara	535	Estimated value	$249,140

A CONSOLIDATION HAS BEEN PROPOSED to include the Montana Tonopah, North Star and Midway companies, of Tonopah. It is proposed to organize an entirely new company with 3,000,000 shares at $1 par to be known as the Montana Tonopah Consolidated Mining Co., although this has not been definitely decided. Out of the 3,000,000 shares of capital stock the Montana Tonopah Mining Co. is to receive 2,000,000 shares in exchange for 1,000,000 shares authorized of the present company and 75% of the capital stock of the Commonwealth Mining & Milling Co., of Arizona, which is now the property of the Montana Tonopah. Shareholders of North Star Tunnel & Development Co. will be tendered 554,455 shares of the new organization for the capital stock of the company, amounting to 1,000,000 shares, while the stockholders of Midway will be asked to exchange their certificates on the basis of 445,545 shares of the new company for the 1,250,000 shares outstanding of the old company. It is stated that the Montana Tonopah property is equipped with a 40-stamp mill having a daily capacity of 300 tons. The North Star and Tonopah Midway properties are so situated that they can be worked with the greatest economy and with every facility through underground connections with the Montana Tonopah workings. Because of this condition of affairs the principals of the proposed merger declare that a great saving will be possible to all companies involved.

White Pine County

CONSOLIDATED COPPER MINES CO.—The initial move to consolidate the Giroux and adjoining properties has been taken by the incorporation under Delaware laws of this company, with $8,000,000 capital, divided into 1,600,000 shares, par $5. The incorporators are Joseph W. Allen, Joseph B. Cotton, of Duluth, and Edward S. Grey, who was associated with James Phillips, Jr., and is the man who originally developed the Nevada Consolidated properties. The Giroux properties are to be merged with the properties of the Coppermines Co., the Chainman Consolidated Copper Co. and the Butte & Ely Co., the control of which already is owned by the Giroux. The merger stockholders of the present Giroux company will be offered one share of the new for each 2½ shares of the old stock. Butte & Ely will go in at one share for 6¼ of the old, but on just what basis the other properties will enter this consolidation has not been divulged. To the Giroux shareholders 150,000 new shares will be allotted, and 175,000 shares of the new company will be used for bond conversion. For the Butte & Ely shareholders, 20,000 shares of the new company will be required, which will leave 55,000 shares available for the Coppermines and Chainman shareholders unless a portion of the bond issue is to be used in this instance.

NEW JERSEY

Morris County

EMPIRE STEEL & IRON CO.—A conference between representatives of the strikers and President Peckitt was held May 26, but the miners' demands that the union be recognized and that the men who had continued to work be discharged was flatly refused; all other demands were conceded by the company.

OREGON

Baker County

BOULDER CREEK—Eight men have been kept busy all winter working the gravel at this mine, although the snow got as deep as 5 ft. on the hills.

UNDERWOOD PLACER—Sydney Coyle, manager of this old mine, states that as high as $218 was taken from one pan of gravel in the last season. The mine is near the old mining town of Cornucopia.

Josephine County

BEAVER CEMENT CO.—This company has been incorporated and has started construction of a plant at Gold Hill. About 500 men will be employed during the summer.

BRIGGS—A large shipment of hydraulic pipe and a No. 2 giant have been received at this mine, which has been bought by Dr. W. B. Pickrell and associates, of Spokane, Wash.

NELLIE WRIGHT—This property is being equipped with a 15-stamp mill and a concentrating plant, which will be in operation within two months. Henry Ray, Gold Hill, is in charge of the work.

JANUARY FIRST—H. G. Siskron, owner of this mine, has just made a cleanup of 96½ oz. of gold that is worth $18.30 per oz., from treatment of 23 tons of ore in an arrastre of crude make. The ore occurs in small stringers. More than 1500 ft. of development work has been done on the property, which is near Holland.

UTAH

Juab County

TINTIC SHIPMENTS for the week ended May 16 were 195 cars.

BALTIMORE—An assessment has been levied to provide working funds, and preparations are being made to resume work.

UNCLE SAM—Lessees are working at this property, which adjoins the Beck Tunnel on the north. Eight blocks of ground are being worked, and are producing about two cars of lead ore weekly.

EAGLE & BLUE BELL—A shoot of ore recently developed on the 1340-ft. level has been drifted on for 70 ft. Part of this is of shipping grade, and contains silver and gold. Ore is being mined from the 700 down, and drifting for ore is being done 80 ft. below the 1340-ft. level.

MAY DAY—About half of the normal tonnage of zinc ore is being shipped by this company on account of the decrease in the price of spelter. Lead ore is being mined and shipped from the 1100 level, which is one of the best showings the property has made for some time.

VICTORIA—The oreshoots on the 1200 are being developed, and with the completion of the new orehouse and loading station, the output will be increased. Drifting is being done on the 1000 to cut ore opened on the level above. Five cars of ore were shipped the week ended May 16.

BECK TUNNEL—A part of this property will be turned over to lessees in the near future. There are many small bunches of ore in the old workings, which can probably be mined so that the lessees can make wages or better. The annual stockholders' meeting will be held June 3, at Provo.

LOWER MAMMOTH—A raise from the 1500-ft. level recently cut a vein, which produced a good tonnage of shipping ore on the 1200. The new ore carries silver, lead and gold, and the strike is approximately 600 ft. from the west end line. Shipments of zinc ore are paying for all development work.

YANKEE—In work east of the shaft on the 2000 level, four fissures have been cut. Drifting on one of these has opened copper-stained rock carrying silver and gold. A raise has been lifted on 6 in. of vein matter, carrying silver, copper and lead. Shipments of zinc ore are being made from the upper levels in spite of the moderate market price for spelter.

CHIEF CONSOLIDATED—Shipments from this property are averaging about 25 cars per week, and it is expected that the output will be increased. The bottom of the shaft is at the 1800-ft. level, and a station has been cut. On the 1600 level a drift is being driven toward the Gemini, and is about 240 ft. from making connection. This will provide better ventilation, and afford an emergency exit. Ore is now being mined from the 10, 14 and 16 levels.

Summit County

PARK CITY SHIPMENTS for the week ended May 3, amounted to 3,394,900 lb.; for that ended May 10, 3,271,340 lb.; for the week ended May 17, 2,570,960 lb. The shippers were the Silver King Coalition, Daly-Judge and Daly West.

SILVER KING COALITION—A new tramway cable has been strung, and this work has curtailed shipments to some extent.

Utah County—American Fork

THE SNOW HAS BEEN MELTING RAPIDLY, and work has been resumed at several properties. Roads are being repaired, and teams have been able to reach the Pacific mine. Work will be started at other properties in Mary Ellen Gulch as soon as the weather permits.

MINERAL FLAT—Lessees at this property have a pile of sacked ore ready for shipment. There is much high-grade carbonate ore in sight. The snow is still too deep to permit hauling.

PACIFIC—Lead-silver ore has recently been cut along the contact of quartzite with the overlying shale. It also makes to a certain extent on some of the shale beds. The ore is largely carbonate but carries galena.

WASHINGTON

Ferry County

BEN HUR—This company has just finished the installation of an Ingersoll-Rand air compressor having a capacity of 1400 cu.ft., and is getting ready to install a 125-hp. hoisting engine which is now on the ground. Regular shipments of 540 tons are being made weekly to the smelter.

NORTH WASHINGTON POWER & REDUCTION CO.—R. A. Koontz and J. W. Turner, of Spokane, have sold 250,000 shares of stock in this company to the Harper Consolidated Mines of Republic. Control of the company thus passes into new hands and a result will be the termination of efforts to combine this company with the Republic Mines Corporation.

WISCONSIN

Platteville District

WISCONSIN ZINC CO.—This company is developing the Hoffman lease, one mile west of Benton.

LA FEVRE RIVER—A Milwaukee company is drilling this property, near Cuba, and also the Field land west of the Winskell mine, at Shullsburg.

VINEGAR HILL ZINC CO.—A 100-ton mill has been completed at the Masbruch, a newly developed property just north of Cuba. This company will erect another milling plant on the Cottingham lease, one mile south of Benton.

PHILIPPINE ISLANDS

PHILIPPINE DREDGING PROPRIETARY CO.—This company has been floated at Melbourne, Victoria, with a capital of £150,000 ordinary stock and £50,000 debenture stock. The company has secured a number of claims on the Paracale River in Luzon, which have been extensively tested by boring. Three dredges are under construction, the first being nearly ready to be shipped to the property.

CANADA

Nova Scotia

DOMINION STEEL CORPORATION—This company's No. 7 blast furnace was blown in May 22, practically completing the program of extension undertaken three years ago, the whole of the new works being in successful operation.

NOVA SCOTIA STEEL & COAL CO.—This company has disposed of its entire output for the year at prices materially higher than those prevailing in 1912. Work is well advanced in sinking the new No. 6 shaft at the Sydney mines and a considerable quantity of coal is being extracted from this pit. The old Jubilee pit is being extended and developed to tap several underlying seams. The increased output is regarded as assuring the production of 1,000,000 tons this year.

Ontario

INTERNATIONAL HEMATITE CO.—This company, which has for some time been prospecting on its property in the Sheep Rock iron-range area, east of Fort Frances, has arranged to put four diamond drills in operation, under the direction of an expert from the Cuyuna iron range in Minnesota.

Ontario—Cobalt

DOME—April production was the largest in the history of the company.

PORCUPINE RESERVE—Diamond drills will be used for exploring this company's property.

BEAVER—The directors have decided to increase the capacity of the mill from 100 to 125 tons per day.

HUDSON BAY—One man was killed and another seriously injured by an explosion in the underground workings of the No. 2 mine.

ALEXANDRIA—The Big Pete vein of the Cobalt Central has been cut in the underground workings, but the grade of the silver ore is low.

LAWSON—Another shoot of high-grade ore has been discovered on the 100-ft. level. This will have a favorable effect upon La Rose production, which has been showing a decline.

PETERSON LAKE—At the annual meeting, soon to be held, the financial statement will show a credit balance of more than $100,000. The fight for control of this property seems to be settled for the time being, as the shares of the leader of the opposition faction have been attached on a judgment.

Ontario—Porcupine

FOSTER—The 5-stamp mill has commenced operations.

BURNSIDE—Surface prospecting has opened a vein, showing about 15 in. of rich ore.

HOLLINGER—The company is again operating on electric power supplied from Sandy Falls and Wawaitin Falls.

DOME EXTENSION—A notice calling for a special meeting of the shareholders, May 28, indicates that the company wishes to increase the capitalization from $2,000,000 to $3,000,000 in order to provide funds for further development.

AFRICA

Rhodesia

Gold production in Rhodesia in April was 57,295 oz., an increase over April, 1912, of 4708 oz., but a decrease of 3979 oz. from March of this year. For the four months ended Apr. 30, the total output was 204,498 oz. in 1912, and 220,622 oz.—or $4,560,257—in 1913; an increase of 16,122 oz., or 7.9%, this year.

THE MARKET REPORT

METAL MARKETS

NEW YORK—May 28

The metal markets continue generally active. Copper exports are large and the prices show only small fluctuations. There is much interest in the auction sale of 2500 tons of Banka tin at Amsterdam this week.

Copper, Tin, Lead and Zinc

Copper—Although the statistical position of the metal is as sound as could possibly be desired, the market is under constant pressure both in this country as well as Europe. Probably conditions as they present themselves just now are in a great measure a reflex of the unsettled financial markets. Consumers, being well supplied, are not disposed to make purchases pending future developments. Such business as was taken was largely obtained in Europe and at material concessions from previous prices. The close is unsettled at 15⅝@15¾c. for Lake copper, and 15.35@15.45c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted nominally at 15.15@15.20c. as an average for the week.

The standard market is selling rather below the parity of refined sorts and fluctuations have been within narrow limits. The close is cabled at £68 7s. 6d. for spot and £68 2s. 6d. for three months.

Base price of copper sheets is 21@22c. per lb. Full extras are charged, and higher prices for small quantities. Copper wire is 16½c. carload lots at mill.

Copper exports from New York for the week were 10,904 long tons. Our special correspondent gives the exports from Baltimore at 4752 tons for the week.

Exports of copper sulphate from the United States for the three months ended Mar. 31, carried the equivalent of 681,000 lb. metallic copper.

Tin—The London market has been rather erratic, advancing during one exchange and declining during the next. The general tendency, however, was downward. The bear party seems to have the upper hand, and is assisted in its operations by reports emanating from this country of a falling-off in consumption of tin. During the latter part of last week there was more interest shown by dealers and consumers in this market, who bought quite freely, but since then the market has relapsed into dullness. The close is weak at £219 for spot, and £215 10s. for three months, and about 48⅛c. for near-by tin here.

Lead—There is a little more pressure to sell on part of the Missouri producers, and in consequence prices in St. Louis have declined at the close to 4.17½@4.20c., while New York is unchanged at 4.30@4.35 cents.

The London market continues on its upward course, due largely to the reduced shipments from Mexico. Quotations at the close are firm at £19 17s. 6d. for Spanish lead, and 7s. 6d. higher for English.

Spelter—The market has been rather demoralized, due to competitive selling in the face of a small inquiry. Quotations at the close are weak at 5.15@5.20c. St. Louis, and 5.30@5.35c. New York. The attitude of domestic sellers was somewhat influenced by the developments abroad, where the Syndicate reduced its price to £23, and in view of the large stock which is said to have accumulated in Europe there are apprehensions that bottom has not as yet been reached. This, in the face of the proposed change in the tariff on spelter has rather unsettled confidence.

The London quotations at the close are cabled at £23 for good ordinaries, and $23 7s. 6d. for specials.

Base price of zinc sheets is now to $7.50 per 100 lb. f.o.b. La Salle-Peru, Ill., less 8% discount.

Exports from Baltimore for the week included 448,000 lb. spelter.

Bismuth—The syndicate which controls the European production quotes 7s. 6d.—equal to $1.80—per lb. in London. In New York a quotation of $1.72 per lb. is made for metal produced from American ores.

Exports and Imports of Metals, other than iron and steel, in the United States two months ended Feb. 28 are reported as follows:

	Exports		Imports	
	1912	1913	1912	1913
Copper, long tons	65,193	64,245	31,046	32,331
Tin, long tons	57	101	8,459	6,918
Lead, short tons	10,074	6,841	19,471	17,887
Zinc, short tons	2,679	242	1,014	368
Zinc, in ore, lb.	6,674,794	264,320	5,591,794	11,589,918
Nickel, lb.	3,961,172	5,290,042	6,706,683	8778,785
Antimony, lb.	.....	30,413	1,789,986	4,062,073
Aluminum, lb.	8,425	10,907	3,221,465	5,,078,288
Platinum, oz.	.....	250	15,987	21,444
Ores, etc.:				
Zinc oxide, lb.	4,452,007	5,183,981	.....	.....
Zinc dross, lb.	279,424	48,690	.....	.....
Zinc dust, lb.	.....	58,806	.....	827,587
Zinc ores, tons	4,587	3,036	8,125	10,231

Copper, lead, nickel and antimony include the quantities of metal in ores, matte, bullion, etc. Quantity of antimony ore is not given. Zinc dust was not given separately last year. The exports include reëxports of foreign material.

DAILY PRICES OF METALS

NEW YORK

May	Sterling Exchange	Silver	Copper		Tin	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St Louis, Cts. per lb.
22	4.8640	60	@15⅝	15.45 @15.55	48¾	4.30 @4.35	4.17½ @4.22½	5 35 @5.40	5.20 @5.25
23	4.8625	59⅞	@15⅝	15.40 @15.50	48½	4.30 @4.35	4.17½ @4.22½	5.30 @5 40	5.15 @5.25
24	4.8635	60¼	@15⅝	15.40 @15.50	48½	4.30 @4.35	4.17½ @4.22½	5.30 @5.40	5.15 @5.25
26	4.8630	60¼	@15⅝	15.35 @15.45	48½	4.30 @4.35	4.17½ @4.20	5 30 @5.35	5.15 @5.20
27	4.8630	60	@15⅝	15.35 @15.45	48⅞	4.30 @4.35	4.17½ @4.20	5.30 @5.35	5.15 @5.20
28	4.8635	60⅛	@15⅝	15.35 @15.45	48¼	4.30 @4.35	4.17½ @4.20	5.30 @5.35	5.15 @5.20

The quotations herein given are our appraisal of the market for copper, lead spelter and tin based on wholesale contracts with consumers without distinction as to deliveries; and represent, to the best of our judgement, the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic. We quote casting copper at 0.15c. below the price for electrolytic. The quotations for lead represent wholesale transactions in open market for good ordinary brands, both desilverized and non-desilverized; the specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium. Silver quotations are in cents per troy ounce of fine silver.

LONDON

May	Silver	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
		Spot	3 Mos	Best Sel'td	Spot	3 Mos		
22	27 11/16	68¾	68⅞	74½	222¾	217	19⅜	24⅛
23	27⅛	68⅝	68 5/16	74⅛	221	216	19⅛	24⅛
24	27 13/16	....	....	....	....	....	....	....
26	27 13/16	68⅛	68⅜	74¾	220¾	216¼	19¾	23
27	27 11/16	68 5/16	68 7/16	74¾	222½	218¼	20	23
28	27¾	68⅜	68½	74½	219	215½	19⅜	23

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c. = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 0.21¾c.

Other Metals

Aluminum—Business has been on rather a large scale. Sales have been pushed, holders of stocks of foreign here wishing to get rid of them before the new tariff takes effect. No. 1 ingots are quoted at 25½@26¼c. per lb. for spot and 26½@27c. for future delivery.

Antimony—The market is very dull. Buyers are waiting for the expected change in duty and are taking only what they need at once. Cookson's is quoted at 8.70@9c. per lb., and Hallett's 8.20@8.50c.; while 7.60@7.90c. is paid for Hungarian, Chinese and other outside brands.

Quicksilver—Business is rather quiet, and prices unchanged. New York price is $40 per flask of 75 lb., with 60c. per lb .for small lots. San Francisco, $38.50 for domestic orders, and $36 for export. The London price is £7 5s. named from second hands.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Nickel—Shot, block and plaquettes are quoted at 40@45c. per lb., according to quality and size of order. Electrolytic nickel is 5c. per lb. higher.

Selenium—Producers of this metal quote large lots at $2.75@3.50 per lb., according to size of order; while as high as $4.50@5.50 is paid for retail lots.

Exports from Baltimore for the past week included a shipment of 1430 lb. selenium to Hamburg, Germany.

Gold, Silver and Platinum

Gold and silver movement in the United States, four months ended Apr. 30:

	Gold		Silver	
	1912	1913	1912	1913
Exports	$21,774,902	$50,697,080	$21,897,247	$23,260,836
Imports	16,106,794	19,961,361	16,039,723	12,671,857
Excess, exp.	$5,668,108	$30,735,719	$5,857,524	$10,588,979

Exports of merchandise in 1913 were valued at $808,257,784; imports, $612,485,974; excess of exports, $195,771,810. Adding excess of gold and silver exports, gives $237,096,608 as the total export balance this year.

Gold—There was no change on the open market in London and the price of gold was unchanged at the Bank level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. After small reservations for India and Egypt, the bulk of the supplies went to the Bank of England. In New York one shipment to Paris was made.

Iridium—Demand continues good and supplies moderate. These conditions contribute to maintain a high price, about $85 per oz. being asked by dealers.

Platinum—Business is steady on about the usual demands. Prices are again unchanged. Dealers ask $45@46 per oz. for refined platinum; while hard metal is $49@52 per oz., according to grade. The foreign market is reported unsettled, with a lower tendency.

Silver—The market has been comparatively steady during the past week. The best informed quarters look for small fluctuations for the present. The impression prevails that the effect of the Chinese loan has been largely discounted during the protracted negotiations of the past six months.

Exports of silver from London to the East, Jan. 1 to May 15, reported by Messrs. Pixley & Abell:

	1912	1913	Changes
India	£2,588,800	£2,769,000	I. £180,200
China	630,000	216,000	D. 414,000
Total	£3,218,800	£2,985,000	D. £233,800

Imports of silver into France, three months ended Mar. 31, were 74,028,000 fr.; exports, 88,167,000 fr.; excess of exports, 14,139,000 fr., which compares with an excess of exports of 6,404,000 fr. last year.

Imports of silver into Great Britain, four months ended Apr. 30, were £5,674,272; exports, £4,905,310; excess of imports £768,962, which compares with an excess of exports of £209,465 last year.

Zinc and Lead Ore Markets

JOPLIN, MO.—May 24

The high price of zinc blende is $47.50, the base per ton of 60% zinc ranging from $43 to $46, for ore under 4% iron, and as high as $48 base for ore higher in iron. Calamine sold on a base of $21@23 per ton of 40% zinc. The average of all grades of zinc is $42.20 per ton. Lead is unchanged at $52.50 per ton of 80% metal contents. The average of all grades is $52.32 per ton.

SHIPMENTS WEEK ENDED MAY 24

	Blende	Calamine	Lead ore	Value
Totals this week	11,769,270	725,900	1,341,060	$298,807
21 weeks	230,134,260	15,301,180	38,563,110	$6,522,580

Blende value, the week, $255,177; 21 weeks, $5,302,763.
Calamine value, the week, $8538; 21 weeks, $204,823.
Lead value, the week, $35,092; 21 weeks, $1,014,994.

PLATTEVILLE, WIS.—May 4

The base price paid this week for 60% zinc ore was $43@44 per ton. The base price paid for 80% lead ore was $52@53 per ton.

SHIPMENTS WEEK ENDED MAY 24

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	2,173,680	225,710	525,160
Year to date	56,659,660	2,945,430	25,671,730

Shipped during week to separating plants, 1,808,500 lb. zinc ore.

IRON TRADE REVIEW

NEW YORK—May 28

Current buying continues rather light, but specifications on orders keep the mills busy, and a resumption of orders is looked for before long. With the active work of the past three or four months, many people believe that buyers are still not oversupplied and that they must soon be in the market again.

Steel manufacturers admit that sentiment among their customers is universally pessimistic, with no disposition whatever to make forward purchases, but point out that there is practically no cancellation or postponement with respect to engagements already made, resulting in shipments being substantially as heavy as at any time; while as some jobbers are endeavoring to reduce their stocks it would appear that actual consumption is in excess of shipments.

Finished steel prices are being very well held along the line considering how adverse sentiment is, there being merely slight irregularities in sheets and wire products.

The mills seem certain to run at very nearly full capacity for months upon business now on books, which the late quietness has shown is dependable, but unless there is an improvement in buying some curtailment is likely in the future, probably in July, when the mills will make more extensive repairs than they otherwise would contemplate.

Exports and Imports of Iron and Steel and of manufactures thereof in the United States, three months ended Mar. 31, are valued by the Department of Commerce and Labor, as below:

	1912	1913	Changes
Exports	$62,625,795	$76,428,477	I. $13,802,682
Imports	6,484,095	8,462,371	I. 1,978,276
Excess, exports	$56,141,700	$67,966,106	I. $11,824,406

Actual tonnage exported, so far as given in the reports, was 674,763 in 1912, and 748,459 in 1913; increase, 73,696 tons. Tonnage of imports was 47,096 in 1912, and 73,892 in 1913; increase, 26,796 tons. In some important lines only values, not tonnages, are given.

PITTSBURGH—May 27

Effective today, the National Tube Co. advances merchant steel pipe and line pipe one-half point or about $1 a ton, making steel pipe, ¾- to 3-in., 79% off list on jobbers' carloads. An advance of one-half point was made in steel pipe Apr. 12, restoring prices as reduced Jan. 1 by one point. That reduction, however, could be considered largely nominal, as it was in full-weight pipe, merchant-weight pipe, which had been selling one point cheaper than full weight, being discontinued entirely. The advance is assumed to be made to steady the market, as there had been cutting in instances by a few independent mills, and specifications were showing a tendency to decrease.

Pig Iron—While the Westinghouse Electric & Manufacturing Co. has not definitely withdrawn its inquiries for pig iron, put out more than three weeks ago, it is practically certain that it will not buy at this time. Sellers took heart when the inquiry came out, hoping purchases would be made which would establish a bottom and invite an upturn, and they are now correspondingly disappointed. Current buying is only of small lots, but this buying is likely to increase as little iron is covered beyond July 1. Basic iron is quotable at $14.50, Valley, as an actual market figure, the former quota-

tion of $15 having been nominal. Other prices are not revised and we quote: Bessemer, $17; basic, malleable and No. 2 foundry, $14.50; gray forge, $14, f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—The market is quiet, and prompt lots are shaded slightly more. Buyers having material due on contracts have been trying to have some deliveries anticipated, in order to avoid paying increased duty, but the latest rumors are that ferromanganese may possibly be put on the free list, instead of being subject to the proposed advance from $2.50 to 15%. We quote contract at $61 and prompt at $60@60.50, Baltimore, with $2.16 freight to Pittsburgh.

Steel—Steel mills assert they have little unfinished steel to spare for the next few months, but are nevertheless making more effect to sell than for some time, while consumers are making an effort to secure still lower prices and are slow to close at present quotations, which are well held, with billets at $26.50 and sheet bars at $27, at maker's mill, Pittsburgh or Youngstown. Rods remain at $30, Pittsburgh.

Sheets—Some mills report specifications improved, and on the whole they are nearly equal to shipments. There is occasional shading on black and galvanized. Production is at the full rate. We quote blue annealed, 10-gage, 1.75c.; black, 28-gage, 2.35c.; galvanized, 28-gage, 3.40@3.50c.; painted corrugated, 28-gage, 2.55c.; galvanized corrugated, 28-gage, 3.50@3.55c. per pound.

IRON ORE

Imports of iron ore in Germany, three months ended Mar. 31, were 3,134,323 metric tons; exports, 636,303 tons. Imports of manganese ore were 173,047 tons; exports, 1844 tons.

Imports of iron ore into the United States, three months ended Mar. 31, were 441,280 long tons in 1912, and 529,062 in 1913; increase, 87,782 tons. Exports of iron ore were 24,230 tons in 1912, and 23,857 in 1913; decrease, 373 tons. Imports of manganese ore were 77,638 tons in 1912, and 142,738 in 1913; increase, 65,100 tons.

COKE

Connellsville coke production is off a few thousand tons, but shipments are steady, and there is no quotable change in prices.

Exports and Imports of Fuel in the United States, three months ended Mar. 31 are reported as follows, in long tons:

	Exports		Imports	
	1912	1913	1912	1913
Anthracite	730,605	823,588	25	13
Bituminous	2,286,260	2,962,696	364,064	378,289
Coke	183,073	239,291	.....	.....
Bunker coal	1,854,464	1,759,040	21,521	14,171
Totals	5,054,402	5,784,615	385,610	392,473

Increase in exports, 730,213 tons, or 14.4%; increase in imports, 6863 tons, or 1.7%. The bunker coal, or coal furnished to steamships in foreign trade, is practically all bituminous. The heaviest exports are to Canada, while that country also furnishes a large share of the imports. The imports are mainly on the Pacific Coast.

Coal and Coke Tonnage of Pennsylvania R.R. lines east of Pittsburgh and Erie, four months ended Apr. 30, short tons:

	1912	1913	Changes
Anthracite	3,579,602	3,674,096	I. 94,494
Bituminous	15,461,920	15,914,179	I. 452,259
Coke	4,190,832	4,987,304	I. 796,472
Total	23,232,354	24,575,579	I.1,343,225

The total increase this year was 5.8%. The largest gain was in coke shipments.

CHEMICALS

NEW YORK—May 28

The general market is rather quiet. Business seems to be waiting for the settlement of the tariff schedules.

Arsenic—Demand is light and supplies good. Prices are again easier, at $3.37½@3.50 per 100 lb.; with $3.75 asked for one or two special brands.

Copper Sulphate—Business is steady, with fair sales. Quoted prices are unchanged at $.25 per 100 lb. for carload lots and $5.50 per 100 lb. for smaller orders.

Nitrate of Soda—Spring trade is over and the market is quiet. Quotations are unchanged at 2.60c. per lb. for spot, 2.55c. for June, 2.50c. for July and August, and 2.47½c. for later deliveries.

Potash Salts—Exports of potash salts from Germany, three months ended Mar. 31, are reported as below, in metric tons:

	1912	1913	Changes
Crude salts	362,474	477,620	I. 115,146
Potassium chloride	95,603	126,838	I. 31,235
Potassium sulphate	25,474	48,065	I. 22,591
Pot.-magnesium sulphate	30,999	29,038	D. 1,961
Totals	514,550	681,561	I. 167,011

Of the exports this year 323,636 tons, or 47.5% were to the United States.

PETROLEUM

It is reported that S. Pearson & Co., large operators in Mexico, have closed a contract giving them the right to explore the oil fields in Colombia, where the indications are very favorable.

COPPER SMELTERS' REPORTS

This table is compiled from reports received from the respective companies, except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept. of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield ther is reckoned at 97%. In computing the total American supply duplications are excluded.

	Jan.	Feb.	March	April
Alaska shipments	1,668,328	660,250	472,293	1,730,252
Anaconda	21,000,000	21,250,000	22,900,000	23,800,000
Arizona, Ltd.	3,100,000	3,000,000	3,200,000	3,100,000
Copper Queen	7,554,966	6,810,706	7,558,709	8,210,166
Calumet & Arizona	4,750,000	4,050,000	4,250,000	4,500,000
Chino	3,298,030	3,898,998	4,464,723	3,925,409
Detroit	1,769,071	1,689,277	1,640,671	1,856,517
East Butte	1,469,000	1,325,000	1,400,000	1,400,000
Mammoth	1,957,804	1,661,150	1,641,091	1,450,000
Giroux	650,000	*600,000	*625,000	.....
Mason Valley	1,655,319	1,348,070	1,608,492	1,264,304
Nevada Con.	4,169,705	4,798,537	5,555,320	5,650,608
Ohio	492,760	380,849	596,651	.....
Old Dominion	2,727,000	2,381,000	2,853,000	3,040,000
Ray	3,610,000	3,610,000	4,287,400	4,379,128
Shannon	1,232,000	1,152,000	1,260,000	1,238,000
South Utah	*ni.*	*ni.*	*nil*	.....
United Verde*	2,900,000	2,750,000	3,000,000	.....
Utah Copper Co.	7,333,495	7,585,303	8,248,880	9,539,847
Lake Superior*	17,500,000	19,000,000	19,000,000	.....
Non-rep. mines*	7,500,000	7,000,000	8,000,000	.....
Total production	96,337,478	94,950,141	102,562,230	.....
Imports, bars, etc.	34,026,236	21,372,292	24,215,480	.....
Total blister	130,363,714	116,318,433	126,777,710	.....
Imp. in ore and matte	7,563,758	9,459,432	11,911,041	.....
Total American	137,927,472	125,781,865	138,688,751	.....
Miami†	2,932,369	2,817,200	3,102,200	2,312,900
Shattuck-Arizona	1,381,422	1,136,480	1,234,450	1,158,326
Brit. Col. Cos.:				
British Col. Copper	720,260	688,312	844,735	794,000
Granby	1,792,245	1,740,000	1,967,962	1,857,452
Mexican Cos.:				
Boleo†	2,658,880	2,535,680	2,204,720	2,811,200
Cananea	5,450,000	4,880,000	4,772,000	3,581,690
Moctezuma	2,913,294	2,730,914	3,062,159	2,753,240
Other Foreign:				
Braden, Chile	1,484,000	1,178,000	1,472,000	1,512,000
Cape Cop., S. Africa	770,540	712,320	732,480	586,880
Kyshtim, Russia	1,644,160	1,352,960	.....	.....
Spassky, Russia	974,400	1,003,520	974,400	.....
Exports from				
Chile	6,752,000	5,824,000	7,840,000	7,616,000
Australia	9,744,000	5,512,000	6,944,000	6,608,000
Arrivals in Europe	17,689,280	8,509,760	15,585,920	10,545,920

† Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.
‡ Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER

	United States			Visible Stocks.		
Month	U.S.Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
IV, '12.	125,464,644	69,513,846	53,252,326	62,367,557	136,819,200	199,186,757
V.....	126,737,836	72,702,277	69,485,945	695,066,02	134,176,000	199,242,029
VI.....	122,315,240	66,146,229	61,449,650	49,615,643	117,801,600	167,417,244
VII....	137,161,129	71,094,381	60,121,331	44,335,004	108,186,000	152,521,003
VIII...	145,628,521	78,722,418	70,485,150	50,280,421	113,299,200	163,579,621
IX.....	140,089,819	63,460,810	60,264,796	46,701,374	113,568,000	160,269,374
X.....	145,405,453	84,104,734	47,621,342	63,065,587	107,408,000	170,473,587
XI.....	134,695,400	69,369,795	55,906,550	76,744,964	103,801,600	180,546,564
XII....	143,354,042	58,491,723	65,713,796	86,164,059	96,947,200	183,111,259
Year, 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
I. 1913.	143,479,625	65,210,030	60,383,845	105,312,582	78,491,840	183,904,422
II.....	130,948,881	59,676,492	72,168,523	123,198,332	77,504,000	200,702,332
III....	136,251,849	76,585,471	77,699,306	122,302,890	81,244,800	203,547,690
IV.....	135,353,402	78,158,837	85,894,727	104,269,270	87,180,800	191,450,070
V.....	.....	.....	.....	75,549,108	85,948,800	161,497,908

Note—From Jan. 1, 1913, visible supplies in Europe do not include copper afloat.

Assessments

Company	Delinq	Sale	Amt.
Algomah, Mich.	June 16	.....	$1.00
Best & Belcher, Nev.	May 20	June 10	0 05
Big Indian Copper, Utah.	May 13	June 4	0 018
Blue Star, Ida.	May 10	June 17	0.04
Booth	May 19	June 23	0.02
Busy Bee, Utah	May 10	June 5	0.0025
Cœur d'Alene Vulcan, Ida.	May 17	June 2	0.01
Deer Trail, Utah	May 8	June 6	0.005
East Cœur d'Alene, Ida.	May 9	June 2	0.002
Field Gold Copper, Utah.	May 13	June 4	0.015
Melcher, Utah	May 29	June 19	0.02
Morning Star, Ida	May 24	June 16	0.001
New Yerington, Nev.	June 10	June 28	0 01
North Lake, Mich.	May 19	.....	1.00
Overman, Nev.	May 28	June 18	0.05
Royal, Ida.	May 31	June 23	0.001
Sandstorm Kendall, Nev.	May 12	June 16	0 01
Seven Troughs Mon., Nev.	May 10	June 7	0.0025
Shasta Copper Exp., Calif.	May 28	June 16	0.025
Trade Dollar Ext., Utah.	May 29	June 17	0.005
Union Con., Nev.	May 14	June 4	0.10
United Copper, Mont.	May 15	.....	0.30
Utah Centennial, Utah.	May 15	June 2	0.002
Utah Mine, Utah.	June 7	June 26	0.05

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1911	1912	1913	1911	1912	1913
January	53.795	56.200	62.938	24.865	25.887	28.983
February	52.222	59.043	61.642	24.081	27.190	28.357
March	52.745	58.375	57.870	24.324	26.875	26.669
April	53.325	59.207	59.490	24.595	27.284	27.416
May	53.308	60.880	.....	24.583	28.038	.....
June	53.043	61.290	.....	24.486	28.215	.....
July	52.630	60.654	.....	24.286	27.919	.....
August	52.171	61.606	.....	24.082	28.375	.....
September	52.440	63.078	.....	24.209	29.088	.....
October	53.340	63.471	.....	24.594	29.299	.....
November	55.719	62.792	.....	25.649	29.012	.....
December	54.905	63.365	.....	25.349	29.320	.....
Year	53.304	60.835	.....	24.592	28.042	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1912	1913	1912	1913	1912	1913
January	14.094	16.488	14.337	16.767	62.760	71.741
February	14.084	14.971	14.329	15.253	62 893	65.519
March	14.698	14.713	14.868	14.930	65.884	65.329
April	15.741	15.291	15.930	15.565	70.294	68.111
May	16.031	.....	16 245	.....	72.352	.....
June	17 234	.....	17 443	.....	78.259	.....
July	17.190	.....	17.353	.....	76.636	.....
August	17.498	.....	17.644	.....	78 670	.....
September	17.508	.....	17.698	.....	78.762	.....
October	17.314	.....	17.661	.....	76.389	.....
November	17.326	.....	17.617	.....	76.890	.....
December	17.376	.....	17.600	.....	75.516	.....
Year	16.341	.....	16.560	.....	72.942	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN

Month	New York		London	
	1912	1913	1912	1913
January	42.529	50.298	191.519	238.273
February	42.962	48.766	195.036	220.150
March	42.577	46.832	192.619	213.645
April	43.923	49.115	200.513	224.119
May	46.063	.....	208.830	.....
June	45.815	.....	205.863	.....
July	44.519	.....	202.446	.....
August	45.857	.....	208.351	.....
September	49.135	.....	223.762	.....
October	50.077	.....	228.353	.....
November	49.891	.....	227.619	.....
December	49.815	.....	226.875	.....
Av. year	46.096	.....	209.322	.....

New York in cents per pound; London in pounds sterling per long ton.

LEAD

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	4.435	4.321	4.327	4.171	15.597	17.114
February	4.026	4.325	3 946	4.175	15 738	16 550
March	4.073	4 327	4.046	4.177	15.997	15 977
April	4 200	4.381	4 118	4.242	16 331	17.597
May	4 194	.....	4 072	.....	16 509	.....
June	4 392	.....	4 321	.....	17 588	.....
July	4 720	.....	4.603	.....	18 544	.....
August	4 569	.....	4 452	.....	19 655	.....
September	5.048	.....	4.924	.....	22.292	.....
October	5.071	.....	4.894	.....	20 630	.....
November	4.615	.....	4.463	.....	18 193	.....
December	4 303	.....	4.152	.....	18 069	.....
Year	4 471	.....	4.360	.....	17.929	.....

New York and St. Louis cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	6.442	6.931	6.292	6.854	26.642	26.114
February	6.499	6.239	6.349	6.089	26.661	25.338
March	6.626	6.078	6.476	5.926	26.048	24.605
April	6.633	5.641	6 483	5.491	25 644	25.313
May	6.679	.....	6.529	.....	25.790	.....
June	6.877	.....	6 727	.....	25.763	.....
July	7.116	.....	6 966	.....	26 174	.....
August	7.028	.....	6.878	.....	26.443	.....
September	7.454	.....	7 313	.....	27.048	.....
October	7.426	.....	7.276	.....	27.543	.....
November	7 371	.....	7.221	.....	26.804	.....
December	7.162	.....	7.081	.....	26 494	.....
Year	6.943	.....	6.799	.....	26 421	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON IN PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1912	1913	1912	1913	1912	1913
January	$15.12	$18.15	$13.32	$17.35	$14.00	$18.59
February	15.03	18.15	13.28	17.22	14.01	18.13
March	14.95	18.15	13.66	16.96	14.10	17 53
April	15.13	17.90	13.90	16.71	14.15	16 40
May	15.14	.....	13.90	.....	14.12	.....
June	15.15	.....	14.11	.....	14 22	.....
July	15.15	.....	14.38	.....	14.38	.....
August	15.43	.....	14 90	.....	14.85	.....
September	16.86	.....	16.03	.....	15.63	.....
October	17 90	.....	17.18	.....	17 22	.....
November	18 07	.....	17 09	.....	18 00	.....
December	18.15	.....	17.45	.....	18.73	.....
Year	$16.01	.....	$14.93	.....	$15.28	.....

STOCK QUOTATIONS

COLO. SPRINGS May 27

Name of Comp.	Bid.
Acacia	.02⅞
Cripple Cr'k Con.	.01
C. K. & N.	.13⅞
Doctor Jack Pot.	.06½
Elkton Con.	.55
El Paso	3.50
Findlay	.03
Gold Dollar	.10½
Gold Sovereign	.02½
Isabella	.10½
Jack Pot	.05
Jennie Sample	‡.03½
Lexington	‡.008
Moon Anchor	‡.01
Old Gold	.02½
Mary McKinney	.57½
Pharmacist	.01½
Portland	.97
Vindicator	.91
Work	‡.004

SALT LAKE May 27

Name of Comp.	Bid.
Beck Tunnel	.05½
Black Jack	.09½
Cedar Talisman	.02
Colorado Mining	.11
Columbus Con	‡.06
Crown Point	‡.02½
Daly-Judge	6.40
Grand Central	.28
Iron Blossom	1.32½
Little Bell	‡.35
Lower Mammoth	.03¾
Mason Valley	5.00
May Day	.08
Nevada Hills	.90
New York	.00½
Prince Con	.37½
Silver King Coal'n	3.70
Sioux Con.	.01
Uncle Sam	.05
Yankee	‡.05

TORONTO May 27

Name of Comp.	Bid	Name of Comp.	Bid
Bailey	.09	Foley O'Brien	.26
Coniagas	7.75	Hollinger	17.00
T. & Hudson Bay	‡64.00	Imperial	.03
Timiskaming	.34½	Jupiter	.47
Wettlaufer-Lor.	.12	Pearl Lake	.54
Apex	‡.02½	Porcu. Gold	14½
Crown Chartered	.00½	Preston E. D.	‡.04
Dobie	‡.15	Rea	.20
Dome	‡17.50	Swastika	.05
Dome Exten.	.09½	West Dome	‡.34½

SAN FRANCISCO May 27

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.01	Belmont	6.77½
Belcher	.19	Jim Butler	.87
Best & Belcher	.04	MacNamara	.16
Caledonia	.84	Midway	.43
Challenge Con.	.04	Mont.-Tonopah	1.60
Chollar	.03	North Star	.67
Confidence	.23	West End Con.	1.22½
Con. Virginia	.11	Atlanta	.16
Crown Point	.20	Booth	.04
Gould & Curry	.02	C.O.D. Con	.04
Hale & Norcross	.06	Comb. Frac	.04
Mexican	.65	Jumbo Extension	.23
Occidental	.70	Pitts.-Silver Peak	.50
Ophir	.11	Silver Pick	.04
Overman	.25	St. Ives	‡.30
Potosi	.02	Tramp Con	‡.02
Savage	.06	Argonaut	‡1.60
Sierra Nevada	.06	Bunker Hill	1.90
Union Con	.11	Central Eureka	‡.15
Yellow Jacket	.24	So. Eureka	‡2.75

N. Y. EXCH. May 27

Name of Comp.	Clg.
Amalgamated	73⅞
Am. Agri. Chem.	50
Am.Sm.&Ref.,com	67¾
Am. Sm. & Ref., pf.	101⅝
Am. Sm. Sec., pf. B	82⅞
Anaconda	37½
Batopilas Min.	1⅜
BethlehemSteelpf	69⅛
Chino	40⅜
Federal M. & S., pf.	39¾
Goldfield Con.	2
GreatNor.,ore,ctf.	33
Guggen. Exp.	47¼
Homestake	100
Inspiration Con.	16⅞
Miami Copper	23⅛
Nat'nalLead,com.	48
National Lead, pf.	104½
Nev. Consol.	16⅞
Phelps Dodge	200
Pittsburg Coal, pf.	81¾
Ray Con	18¾
Republic I&S,com.	23½
Republic I & S, pf.	82½
SlossSheffil'd,com.	29
Sloss Sheffield, pf.	88
Tennessee Copper	34½
Utah Copper	50
U. S. Steel, com.	60⅛
U. S. Steel. pf.	106
Va.Car. Chem., pf.	103

N. Y. CURB May 27

Name of Comp.	Clg.
Barnes King	1 28
Beaver Con	.35
Braden Copper	7
B. C. Copper	3
Buffalo Mines	2¼
Caledonia	‡ 40
Con. Ariz. Sm.	⅝
Davis-Daly	2 7/16
Diam'field-Daisy	.04
Ely Con	.06
Florence	.37
Giroux	1⅞
Gold Hill Con.	‡⅛
Greene Cananea	6½
Greenwater	.07
Internat. S. & R.	‡113
Kerr Lake	3 1/16
Keystone	‡2
La Rose	2¾
McKinley-Dar-Sa.	1 13/16
Min. Co. of A. new	2 11/16
Motherlode Gold.	‡.60
Nev. Utah M. & S.	‡ 01
Nipissing Mines.	8⅞
Ohio Copper	¾
Pacific Sm. & M.	1/16
Puebla S. & R.	2 1/16
South Live Oak	‡2
South Utah M. & S.	⅛
Standard Oil (Old)	‡1030
Stand'd Oil of N.J.	368
Stewart	1 1/16
Tonopah	5⅛
Tonopah Ex.	2¾
Tonopah Merger.	.80
Tri-Bullion	3/16
Tularosa	1/16
Union Mines	1/16
United Cop., pfd.	3
Yukon Gold	2½

LONDON May 27

Name of Com.	Clg.
Camp Bird	£0 19s 3d
El Oro	0 15 3
Esperanza	1 6 3
Mexico Mines	5 12 6
Oriental Con.	‡1 8 4
Oroville	0 6 3
Santa Gert'dis	1 5 0
Tomboy	1 6 3

BOSTON EXCH. May 27

Name of Comp.	Clg.
Adventure	1⅛
Ahmeek	295
Algomah	.45
Allouez	32
Am. Zinc	22¾
Ariz. Com., ctfs.	3
Bonanza	.38
Boston & Corbin	½
Butte & Balak	1⅞
Calumet & Ariz.	64¾
Calumet & Hecla	445
Centennial	12½
Cliff	1½
Copper Range	42
Daly West	2½
East Butte	11½
Franklin	5¼
Granby	62
Hancock	18
Hedley Gold	32
Helvetia	.35
Indiana	83¾
Island Cr'k, com.	46¾
Island Cr'k, pfd.	81⅝
Isle Royale	23
Keweenaw	1¼
Lake	12
La Salle	4⅛
Mass	3½
Michigan	1¼
Mohawk	81½
New Arcadian	1¾
New Idria Quick	3½
North Butte	28½
North Lake	1¾
Ojibway	1
Old Dominion	46½
Osceola	84
Quincy	62
Shannon	8½
Shattuck-Ariz.	24¾
Superior	27¾
Superior & Bost.	2¾
Tamarack	27
Trinity	3¼
Tuolumne	2
U. S. Smelting	38¾
U. S. Smelt'g. pf.	46⅝
Utah Apex	1¾
Utah Con.	7¾
Victoria	1
Winona	1¼
Wolverine	50
Wyandot	¾

BOSTON CURB May 27

Name of Comp.	Last
Alaska Gold M.	11½
Bingham Mines	3½
Boston Ely	.54
Boswycocolo	‡.01
Butte Central	1⅜
Cactus	07
Calaveras	3 7/16
Chief Cons	1½
Corbin	.90
Cortez	.35
Crown Reserve	3 11/16
Eagle & Blue Bell	.95
First Nat. Cop.	1 13/16
Majestic	36
Mexican Metals	.70
Moneta Porc.	‡.06
Nevada-Douglas	1 13/16
New Baltic	.90
Oneco	.85
Raven Copper	.07½
Rhode Island Coal	03
Smokey Dev.	1½
S. W. Miami	2½
South Lake	5
Trethewey	.30
United Verde Ext.	.67

‡Last quotation.